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ABSTRACT

This issue of ENC Focus is organized around the theme of mathematics and science in the real world. It intends to provide teachers with practical resources and suggestions for science and mathematics education. Featured articles include: (1) "Real-World Learning: A Necessity for the Success of Current Reform Efforts" (Robert E. Yager); (2) "Exploring Science through the GLOBE Program" (Kay Berglund); (3) "Cockatiels to Kittens: Animal Behavior in the Real World" (Leah M. Melber); (4) "Mathematics Projects That Foster a Critical Look at Our World" (Fanny Sosenke); (5) "Water on the Web" (Bruce H. Munson, George E. Host, Cynthia A. Hagley and Richard P. Axler); (6) "Architecture: An Across-the-Curriculum Project Connects to the Community" (Liesa Schroeder); (7) "Aquaponics Encourages Fourth Graders To Eat Their Vegetables" (Crystal McGee); (8) "Using Technology and Real-World Connections To Teach Secondary Mathematics Concepts" (Hollylynne Stohl Drier, Kara M. Dawson, and Joe Garofalo); (9) "Design Challenges Propel Earthly Problems into Orbit" (Anne Ireland); (10) "Math from the Toy Store" (Robin Cohen); and (11) "Hunting for Asteroids, Comets, and Novae" (Dennis Erickson). (ASK)

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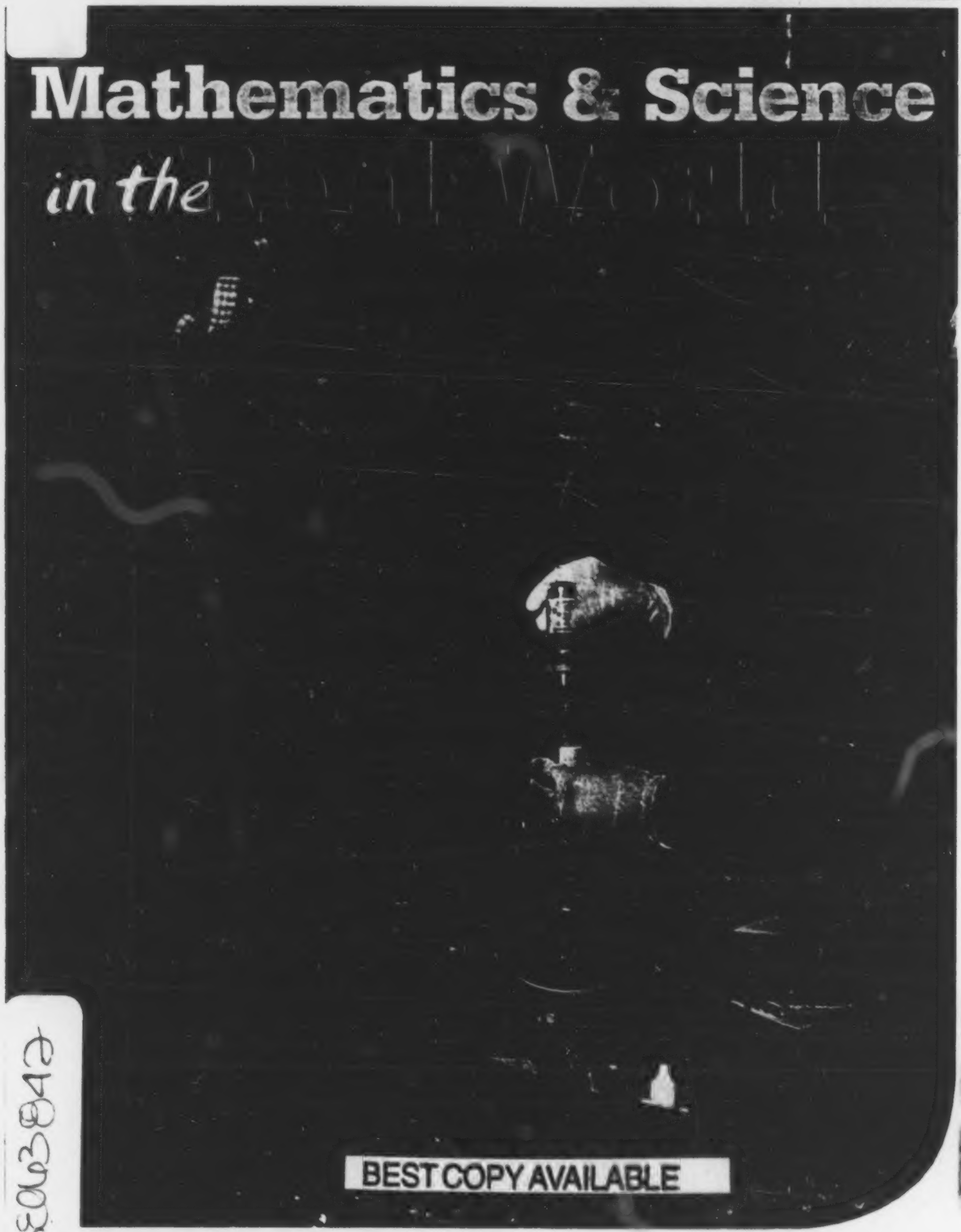
enc focus

vol. 7, no. 3, 2000

A Magazine for Classroom Innovators

Mathematics & Science in the Real World



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Collaborates with the National Network of Eisenhower Regional Consortia and Clearinghouse and many other organizations to promote education reform.

Supports teachers' professional development in math, science, and the effective use of technology.

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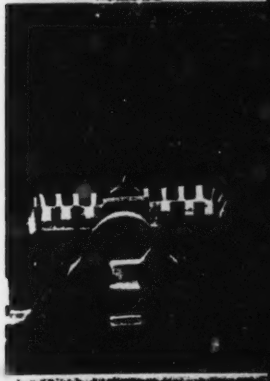

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ENC Focus: A Magazine for Classroom Innovators, Volume 7, Number 3

Theme for this Issue: Mathematics & Science in the Real World

UPDATE

This icon invites you to visit the Internet for more information, more resources, more ideas for your own classroom innovations. The online version of this publication will help you get started. Visit enc.org/focus/realworld

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update

Around the Clearinghouse
and the Nation

editorial

BEYOND CURRICULUM:

Getting Real with our Students

by Annette Thorso

When we launched *ENC Focus: A Magazine for Classroom Innovators* more than a year ago, an important goal was to fill the publication with articles written by teachers. The problem, we thought, would be encouraging these busy people to find time to write. Apparently, as this issue illustrates, finding the right topic is the key. As soon as we announced the topic Mathematics and Science in the Real World, we were deluged with inquiries—and articles—from classroom teachers.

Anyone who understands teachers knows why connecting mathematics and science with the Real World interests them so much. Teachers strive to put the needs of their students first, and that means trying to make what happens in the curriculum relevant to their lives. Teachers' interpretations of ways to accomplish this are illustrated in the articles you will find in this issue.

Approaches are varied. Leah Melber shows how primary grade children can study animal behavior by observing their pets (page 23), while Fanny Sosenke's middle schoolers plan a vacation budget (page 26). Liesa Schroeder's students use digital cameras to analyze the architecture of buildings in their community (page 33), and the fourth graders in Crystal McGee's class use aquaponics to grow their own vegetables (page 35).

Anne Ireland (page 39) and Dennis Erickson (page 43) help students experience the vast reality of outer space, while Robin Cohen's students learn ratio and proportion through hands-on work with toy miniatures (page 43).

A number of teachers felt that the Internet connects the real world to the classroom. Kay Berlund shows how her fourth graders contribute data through the GLOBE program (page 20), Bruce Munson and colleagues describe a web site they designed especially for science teachers (page 30), and Hollylynne Drier and colleagues suggest ways to use Internet data to teach mathematics concepts (page 36).

Part of our process for defining this and other *Focus* topics is through discussion with ENC's teacher advisory group, which meets for dinner at our offices about once a month during the school year. When we asked the group to tell

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us what Mathematics and Science in the Real World meant to them, their ideas were similar to those of the teachers who had contributed articles to the magazine.

However, group member Joan Smith, who teaches in Westerville, Ohio, took our request one step further: she asked her second grade students at Emerson Elementary School to do a "quickwrite" in their Learning Logs on what the real world meant to them. One child echoed the underlying message of many of the teachers:

> The real world is what we live in. It is our home. There is no place like it in the universe. It's the only planet that has plants or animals. It is a cool place.–Alex

But many of these seven-year-olds had different perspectives. Here are some excerpts:

> The real world means if you steal something you can get arrested. But if you steal something when you are a kid, you can't get arrested... The real world can be rough. In the real world you can get hurt and arrested.–Matt

> ...you have to be really responsible. You are here for a reason–to be a good person and make people feel better and help another person.–Emily

> I think the real world means get with the action. Also don't go on your own little cloud in your own little world... Do what you are supposed to be doing. Find your brain and use it!–Olivia

> ...when you are young you are not in the real world because you always get another chance, but when you are a grownup you don't get another chance... When you are young you are in an easier world.–Mike

> I think the real world is like a place for grownups because when you are little you are in the little world and you go to school and learn from your mistakes. Then when you grow up, that's when you are in the real world, and when you are in the real world you go to work and have kids.–Alyssa

> I think the real world is something that is not in your imagination. Like if you thought that there was a monster under your bed, in the real world there isn't. Or if you thought dogs could talk, in the real world dogs can not talk. So I think that the real world is what is happening in your real life, and not your imagination.–Sarah

> The real world means...a planet that we live on...the real world is the only place that you learn how to do math problems.–Keaton

> I think the real world means that you...can't always depend on someone to be there when you need some help. It also means you can get in more trouble. When you are in the real world you aren't in the kid world or the baby world.–Heather

> I think the real world is a grownup world not a child's world. I also think that no one looks after you.... You can't count on your teacher to tell you if it is right or wrong. You have to figure it out on your own.–Brooke

Maybe some of these real-world concerns are beyond the scope of our curricula. But I think most teachers would agree that we need to listen and be aware. In the meantime, perhaps we can help more of our children share the view of this very wise second grader:

> This is a story about what the real world means to me. The real world means to me–not an easy life, but not a hard one–a kind of between like life. I think the real world is not supposed to work out the way you want it to all the time. To be in the real world is not to daydream. It is to be awake and alert In the real world if you want to do something new then go there and do it your way. Try some new stuff!–Lauren

Calling All Classroom Innovators:

WRITE FOR ENC!

ENC invites readers to contribute articles for upcoming issues of *ENC Focus: A Magazine for Classroom Innovators.*

Topics and Deadlines:

The Standards-Based Classroom
Submissions due September 1, 2000

Literacy in Mathematics and Science
Submissions due December 1, 2000

New Horizons in Mathematics and Science Education
Submissions due March 1, 2001

Topics and deadlines subject to change without notice.

Writers' Guidelines are on page 22.

Innovators' Forum Online

While no one has answers for all the issues facing educators today, progress is possible when classroom innovators, like yourself, exchange ideas.

To make such an exchange possible, the online version of *ENC Focus: A Magazine for Classroom Innovators* (enc.org/focus/) features an electronic Innovators' Forum. Readers are invited to send concerns and comments via email to editor@enc.org. Selected messages will be published online, and of those, a few will appear here, so that readers of the print version of the magazine can participate.

Since an upcoming issue of ENC Focus is on the topic of Educational Equity, we particularly invite responses to this message:

> ***Dear Innovators,***
>
> *I think it is true that girls often hang back in mathematics and science for fear of alienating the boys. I find that my high school girls excel in math and science, but we are an all girls' high school. Many of these girls come from our co-ed elementary school where they have been accelerated in math and science.*
>
> *I do know that our parents are involved and expect the students (both boys and girls) to do well and go on to four-year colleges. Our teachers also expect everyone to do his/her best, and they will not let someone slack off for social reasons.*
>
> *Maybe what needs to be done is to educate parents and teachers so they don't impart these negative ideas in the girls' heads. Girls don't learn that they "can't do" math on their own; someone had to plant the seed of doubt.*
>
> *Pat Pietruszka, Math Teacher and Technology Coordinator*
> *Nardin Academy*
> *Buffalo, New York*

Please keep in mind that Innovators' Forum offers a way for you to discuss issues with other classroom innovators. You can get information and answers to many educational questions from ENC's Information Services Department. Contact them by email library@enc.org or telephone (614) 292-9734.

When you contribute to Innovators' Forum, please include your full name, your title or the grade you teach, the name of your school or district, and your city and state. Please note that comments selected for publication may be edited for brevity and clarity and that by submitting them you are giving permission for your comments to appear in both the print and the online versions of this publication.

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ENC's Partners

SUMMIT ON SCIENCE

ENC joins in a sweeping effort to publicize the need for science literacy for everyone.

by Steve Weaver, ENC Collaboration

The need for true reform in science education in the United States creates a constant stream of dialog. Corporations, politicians, educators, parents, students, and communities as a whole are clamoring for the "right" answer to making education more relevant to the needs of our society. Fueling this dialog are various indicators, such as results on TIMSS (Third International Mathematics and Science Study) and other data, that show US students lagging behind their counterparts in other countries in mathematics and science learning.

Many groups and individuals have offered possible solutions for systemic educational reform, but no one corporation, organization, or professional society has the resources to insure that their initiatives reach every school or even every district. The answer may lie in a national awareness program that helps to spur local efforts throughout the country.

Summit on Science is such a program.

Summit on Science (SOS) is a collaboration of corporations, non-profit organizations, and government agencies, whose goal is to promote the importance of science literacy. The first-ever integrated approach of its kind, Summit on Science is a massive effort to bring science literacy to all people.

The SOS collaboration boasts some of the most prominent leaders in science educational reform in the United States today. See sidebar for a complete list. Eisenhower National Clearinghouse is proud to be a partner in the SOS effort. ENC will provide assistance in selecting exemplary science curriculum resources and disseminating information about quality science-related web sites.

Summit on Science is spearheaded by Science Service, a Washington, DC-based non-profit organization. Founded in 1921, Science Service is one of the most respected non-profit organizations advancing the cause of science. As publisher of *Science News*, and as administrators of the Intel Science Talent Search, the Intel International Science and Engineering Fair, and the Discovery Young Scientist Challenge, Science Service encourages students, parents, teachers, and communities to explore the vast world of science. For more information about Science Service, visit www.sciserv.org.

Alfred Berkeley

SOS members have been meeting since 1998 to plan national events that will serve as a call to action for science education reform. On February 16, 2000, SOS announced plans at a press conference held at the Hardy Middle School in Washington, DC. National Academy of Sciences President Bruce Alberts, Nasdaq Stock Market President Alfred Berkeley, Nobel Laureate Leon Lederman, and sports and entertainment stars were on hand to outline these SOS events:

- Official Kick-off, Summer 2000—Summit on Science is scheduled to commence in conjunction with the annual National Governor's Conference in State College, Pennsylvania. Since education is always a key issue for state government, it is fitting that governors from each state help announce and highlight SOS.

- Community Awareness Month, October 2000—More than 500 aquariums, zoos, science and technology centers, and museums will open their doors to help promote science literacy. This month-long campaign will communicate to the general public that science literacy is not only important, but it is also easily accessible.

- The Summit, November 20, 2000—The actual Summit, to be conducted as a town meeting, will offer parents, educators, corporate leaders, and organization representatives an opportunity to openly discuss issues in science literacy. The focus of the Summit is to issue a national call to action and to encourage implementation of this action at the local level.

- Give Smart, Give Science, December 2000—The Give Smart, Give Science holiday campaign will publicize how gifts of educational toys and books can encourage science learning.

SOS is a national program that will focus on local results. Every community will be encouraged to work to create true educational reform—the kind of reform that is felt by those who need it most.

For more information about Summit on Science, visit the SOS web site at www.summitscience.org ●

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Kevin Kuhn, 1999 winner of the Discovery Young Scientist Challenge, performing a science demonstration at the SOS press [illegible]

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Email: buckleyp@ael.org
aelinfo@ael.org
URL: www.ael.org/eisen

demo site

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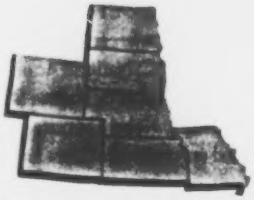
Mid-continent Region

Colorado, Kansas, Missouri, Nebraska, North Dakota, South Dakota, Wyoming



consortium

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Far West Region

Arizona, California, Nevada, Utah

consortium

WestEd Eisenhower Regional Consortium for Science and Mathematics Education
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North Central Region

Illinois, Indiana, Iowa, Michigan, Minnesota, Ohio, Wisconsin

consortium

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demo site

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Mid-Atlantic Region

Delaware, District of Columbia, Maryland, New Jersey, Pennsylvania

consortium

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demo site

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Northeast and Islands Region

Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, Vermont, Puerto Rico, Virgin Islands

consortium

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demo site

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Contact the Eisenhower Consortium or ENC Demonstration Site that serves your state for assistance in improving mathematics and science education.

Northwest Region
Alaska, Idaho, Montana, Oregon, Washington

consortium

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Fax: (503) 760-5592
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URL: www.col-ed.org/smcnws

demo site

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Southeast Region
Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina

consortium

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demo site

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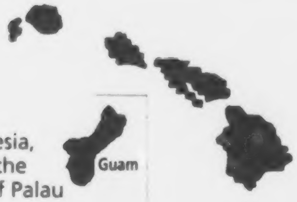
Email: edanderson@mindspring.com

Pacific Region
American Samoa, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Guam, Hawaii, Republic of the Marshall Islands, Republic of Palau



consortium

Pacific Mathematics and Science Regional Consortium
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demo site

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Southwest Region
Arkansas, Louisiana, New Mexico, Oklahoma, Texas

consortium

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demo site

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Eisenhower National Clearinghouse for Mathematics and Science Education
Columbus, Ohio

demo site

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enc
Eisenhower National Clearinghouse

ENC Capital Collection & Demonstration Site
Washington, D.C.

demo site

Shirley DeLaney-Butler
The George Washington University
Instructional Media & Materials Center
Gelman Library, Room B06
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Washington, DC 20052
Phone: (202) 994-7048
Fax: (202) 994-4520
Email: enc@gwis2.circ.gwu.edu
URL: www.gwu.edu/~immc/

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ENC

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ENC in Action

In on the Ground Floor: ENC Helps One School Get off to a Good Start

ENC Online helps make Internet information more manageable for this science teacher and his colleagues.

by Bob Riddle, Science Teacher, Kansas City, Missouri

I teach general science to a mixture of sixth and seventh grade students at Southwest Charter School, a newly formed school in Kansas City, Missouri. As anyone in a similar position will surely agree, teaching middle school science has its own peculiar quirks and challenges, and among those challenges is finding lessons and activities that can engage the very active mind of a middle schooler.

We decided that to be most effective, we should organize the school into grade-level teams consisting of core teachers. We use block scheduling so that our elective teachers can teach classes for both teams. Having a block schedule also allows us the flexibility to manage project-based learning.

Each quarter, students become involved in a thematically linked project involving their core and elective classes. This year, our students' projects included tracing their ancestors as they immigrated to the United States. In another project, designed to coincide with the Mars Polar Lander, students imagined and modeled what it would be like if they, as adults, were to design a colony on Mars. Each project culminates in a Quality Night when family members and the public are invited to hear our students present their project displays.

Pulling all of this together while simultaneously opening a new school was a challenge, and quite frankly it still is. However, one resource in particular—the Internet—has made an incredible difference in the quality of materials students have access to. It has also provided a wealth of information that has been invaluable in helping us as faculty figure out what we were (and are) doing.

Because of the awesome amount of information on the Internet, a certain degree of organization or structure is necessary to manage it. This is where the ENC web site (enc.org) has been most useful for us as individuals working in our content areas and also as a team collaborating on our projects.

Through various links from ENC Online, we have access to the Show-Me standards for mathematics and science. We can also find appropriate lesson plans or activities for our grade levels.

In addition, our faculty often engages in discussions and debates about issues such as classroom strategies, scheduling, and, especially, assessment. Some of the resources that I use as "ammunition" during these discussions are materials that I find through ENC's web site, especially *ENC Focus* articles and reprints of current and past articles from a variety of educational publications.

Visit enc.org to explore the ways ENC Online can help you in your work! ●

In addition to teaching science at Southwest Charter School, Bob Riddle also writes Scope on the Skies for NSTA's Science Scope *magazine; he is also the editor of the online astronomy newsletter* Qué tal in the Current Skies *(www.currentsky.com).*

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See Your Story on this Page!

Do you have a story about how you used ENC products or services? Please email it to us at editor@enc.org or mail to Focus Editor, ENC, The Ohio State University, 1929 Kenny Road, Columbus, OH 43210-1079.

Using the Internet

Designing a Classroom Web Page

Creating your own web site is worth the effort. Here are some tips.

by Kimberly S. Roempler, Instructional Resources

How Does It All Work?

Having an understanding of how the World Wide Web works is helpful when creating your own web page. Here are some of the basics.

The Internet is a giant computer network that connects other computer networks. The World Wide Web (WWW) is a collection of electronic documents that combine text, graphics, multimedia, and links between files. This linking between files creates a giant "web" of easily accessible information.

Each document on the web, a web page, is based on a file that can include text, graphics, or other multimedia as well as links to other documents. A web page is stored on a web server that is connected to the Internet and can answer requests made in a particular communications language, called HTTP (HyperText Transfer Protocol).

When you access the web, your web browser (e.g., Netscape Navigator or Microsoft Internet Explorer) retrieves information from the Internet. When you access a web page, your web browser fires off a request over the Internet for a file specified by an address or URL (Universal Resource Locator). Your computer connects to the web server that has that file. The file is then transmitted over the Internet to your computer, where your web browser displays the file.

HTML (HyperText Markup Language) is not a word processing tool, desktop publishing application, or programming language, but rather strings of text called tags that enable the file to be interpreted by a web browser. You can use programs such as Notepad or WordPad to create and save HTML files. Saving text files with an .htm or .html extension will allow a browser to recognize it as containing HTML tags. Most browsers allow you to view the HTML tags used to design web pages. This set of tags, called the source code, can be accessed under the View menu of your browser.

Every day, the Internet brings together millions of people from all over the globe. It can also work on a smaller scale in your school, connecting parents and their children, teachers and their students, and parents and teachers.

A school web site can publish information such as news, calendars, directory information, and lunch menus. Families can communicate with teachers via email, view student projects and homework assignments, and take virtual field trips. Online forums can allow students and parents to exchange ideas and opinions and to voice questions, praise, and concerns. A collection of web links suggested by the school can guide families to other sites of interest.

If your school is not publishing online yet, you can take the lead by creating a classroom web page. Individual homepages created by teachers can begin by listing homework, notes, and news, then expand to serve other functions. The process of publishing on the web is surprisingly easy and inexpensive, but the exact techniques you will need to use depend on the software and hardware you have available. This article provides some general guidance to get you started.

Web Access

The first thing you need is web access—in other words, you have to get wired. Many of you already have access through your school. Access at home can be achieved through services such as America Online (AOL) or through your local cable company.

Setting Goals

The second step is setting goals for your web site. A typical goal for a classroom site is to provide better communication between you and the parents of your students. What kinds of information would provide that?

As a parent, I know that one piece of information I can use before school starts each year is a supply list for my daughter Kelly's class. Last year, when she started third grade, the list was sent home via regular mail, but I misplaced it 10 minutes after I opened it.

In addition to basic information, a classroom page could provide a virtual field trip so Kelly and I could look at her classroom, thereby diminishing some of her new-school-year jitters. An explanation of her new teacher's teaching philosophy and what she wanted to accomplish over the school year would have helped relieve mine. Examples of excellent classroom web pages that do all that and more are Mrs. Bogucki's Third Grade Class Web Page and Mrs. Silverman's Second Grade Class Web Page (see Recommended Resources on p. 13).

Creating the Content of Your Site

Once your goals have been set, you need to create a storyboard—a diagram that specifies what is on each page of the site and how the pages fit together. This is the time to decide what links to use between pages in your site and which external links to use. Look at existing sites to get ideas on how the designers added navigation tools, graphics, and links to other sites. You can imitate successful elements without violating copyright laws.

The next step is to create your site on your own computer. What content would be of interest to parents and students? The possibilities are almost limitless. You could include copies of course syllabi, links to state and district standards, descriptions of class projects, homework assignments, links to district policy documents, student work, links to homework and ask-an-expert web sites, and much more.

In planning your content, be aware that using the names and photographs of children on web sites can lead to problems. In her class web pages, Mrs. Bogucki uses noms de plume for her students, and she does not include pictures of the children on the site. Check with your school district for policies regarding this issue. Even if your district has no policy, be sure to get parents' written permission before putting a child's name or picture on your site.

HyperText Markup Language (HTML)

Web pages are text documents with graphics, multimedia, and links. But how is that special formatting and linking information stored in the text document? It is stored in special strings of text called tags. The format of these tags and what each tag means are determined by a specification called HTML or HyperText Markup Language.

After you have created the content of your web site, it needs to be converted to HTML. You can do this in two different ways: you can design it from the ground up inserting the HTML tags yourself or use web-authoring tools.

Web authoring tools include HTML editors or WYSIWYG (What You See Is What You Get, pronounced wiziwig) editors that require no knowledge of HTML. Graphical and multimedia elements, such as photos, sound bytes, and video clips, can be added through either type of authoring tool.

HTML editors assist you with various tasks including fast insertion of common HTML tags, choice of colors, auto-upload capability, fast review modes, and more. These editors handle the management of the HTML tags for you. An example of an HTML editor that is available for free is BBEdit Lite (for Macs only).

WYSIWYG editors hide the HTML tags completely and allow you to see what the pages look like. This type of tool also allows you to link to other web locations without typing the URL or pathname. These editors cut, paste, and resize graphics, and create and edit tables and forms. FrontPage Express and WEB Wizard (both for Windows only) are two WYSIWYG editors that are free to users. Netscape Composer combines word-processing-like features with a web surfing environment. GeoCities and America Online also offer easy-to-use, fill-in-the-blank tools that help you quickly create an initial web page. I have listed tools that are free—many more are available for a fee.

Going Online and Testing Your Site

Luckily, server space for small web pages is often either free or inexpensive. Many schools and districts now have their own servers just for this purpose. Check with the technology coordinator or staff person most likely to know about this before seeking external server space.

If you are an America Online customer, you can get a limited amount of server space included in the fees that you already pay. Cable modem hook-ups usually provide at least 5K of server space at no extra charge. GeoCities, the Internet's biggest personal web page publishing site, gets you on the web quickly and includes free server space for personal homepages.

Another alternative is HighWired.com, which has made web publishing free for schools across the country by developing template-based programs, so that knowledge of HTML or File Transfer Protocol (FTP) software is not required. Every department in your school can have its own site, and individual classroom sites can also be created. The system allows teachers to post course overviews, policies, syllabi, and projects; receive student assignments online; and showcase student work. Examples of schools that have taken advantage of this free service include W.E. Parker Elementary School in Edgefield, South Carolina; Eagles Landing Middle School in McDonough, Georgia; and John Glenn High School in Norwalk, California. Go to www.highwired.com and click on these schools to see what this site has to offer.

Once you have chosen your web service provider, the next step is transferring your files to the web server using FTP software. When this transfer occurs, your site is online. Although this is very exciting, it is not the same as the official launch or grand opening of your site. Before you really go public, it is very important to test your site thoroughly on as many different computers as you can. Try it at home and at school. Ideally, the parent of a current or former student should give some feedback—after all, that is your target audience. You can also ask your friends to view the site and provide suggestions. (As an alternative to going online for your testing phase, testers can look at your original file sent to them as an email attachment or on disk.)

This testing will reveal problems that can arise from the inconsistencies found in the web. Different browsers display the same HTML tags differently. Some browsers support newer or nonstandard tags, so pages displayed in them look better—or at least different—from the way they look on other browsers.

Connection speed, related to such factors as modem speed, also varies. That means that graphics-rich pages load very slowly on machines that have slow connections. Different users have different screen sizes, fonts, and window sizes. This causes the same web page to look quite different on different machines.

The key to overcoming these problems is to keep your pages as simple as possible—use standard HTML features and simple web page layouts.

Launching and Maintaining Your Site

If your site is online during the testing phase, it is accessible to Internet users, but probably the only people who will visit it will be those you have invited to test it. After you have revised your site based on tester feedback, you are ready to launch.

Reaching your true audience will take some public relations effort on your part. You will need to inform parents about the site and help them access it by providing a demonstration at a school open house. The time of your launch may also be the opportune moment to enlist the support of your school administration and other teachers.

Once your site is functioning on the web, be sure to update it regularly including checking for links that no longer work. You can also revise your site, adding new content and links. Keep a list of ideas as well as documents and graphics that you would like to add later when your comfort level increases and, of course, when you have time.

You Can Do It!

There is no way one magazine article can provide step-by-step instructions on how to go about this whole process, but a multitude of books and online resources, some on the Recommended Resources list, can help. Taking a class will make you even more proficient. Another resource might be students in your class or their parents. Ask for volunteers to help you get a classroom web page launched.

Creating a web site may seem like a huge undertaking, but you will be surprised at how easy it is and pleased with the result. I know I was. In preparation for writing this column, I created my own personal web site. Check it out at www.geocities.com/kimroempler. ●

JUMP ONLINE!

Connect to all the web sites mentioned in this magazine via the online version
enc.org/focus/realworld

Roempler's Recommended Resources

FREE PERSONAL WEB PUBLISHING SITES

GeoCities - www.geocities.com
This site offers easy page-building tools for people at every ability level: the Wizard tool is for beginners, and PageBuilder templates don't require knowledge of HTML. An Advanced HTML editor is also available. You can use FTP to transfer your own files or GeoCities' EZ Upload tool instead. Provides 15MB of free server space. The advertisements are as low-key as possible. Rated as Editor's Choice by CNET.

AOL Hometown - www.hometown.aol.com
This site has a clean, easy-to-navigate interface and offers slick tools for AOL members. Provides 12MB of free server space.

Lycos Tripod - www.tripod.lycos.com
Excellent page-building tools are available here. Lycos even pays you for good traffic to your site if you meet certain requirements. Provides 11MB of free server space.

ONLINE GUIDES

The Barebones Guide to HTML - www.werbach.com/barebones

TUCOWS, The Ultimate Collection of Winsock Software - www.tucows.com
Each tool gets a rating in number of cows.

Carl Davis' HTML Editor Reviews -
www.homepage.interaccess.com/~cdavis/edit_rev.html
Reviews a variety of authoring tools, comparing the basics of each package.

Writing HTML: A Tutorial for Creating Web Pages -
www.mcli.dist.maricopa.edu/tut/

FREE AUTHORING TOOLS

FrontPage Express - www.microsoft.com/frontpage

BBEdit (Mac only) - www.barebones.com

Netscape Composer - www.netscape.com

FILE TRANSFER PROTOCOL RESOURCES

FTP - File Transfer Protocol -
http://www.imaginarylandscape.com/helpweb/ftp/ftptop.html

Windows Sockets File Transfer Protocol Client -
http://www.gabn.net/junodj/ws_ftp32.htm
Free of charge only to non-commercial home users, students and faculty of educational institutions, and to U.S. federal, state, and local government employees.

Fetch for the Macintosh - http://mac.map.com/mail.html
Free download.

TEACHER HOME PAGES

Mrs. Bogucki's Third Grade Class, Anne E. Moncure Elementary School, Stafford, Virginia - hbogucki.staffnet.com/aemes/default.htm

Mrs. Silverman's Second Grade Class, Clinton Avenue Elementary School, Port Jefferson Station, New York - www.kids-learn.org/class98

STUDENTS WRITE

Publication Opportunities Encourage Student Thinking

This middle school science teacher explains how he motivates his students to write; excerpts from their work demonstrate their enthusiasm.

by Michael J. Calhoun and Middle School Science Students, Alexandria, Virginia

When students enjoy a science activity, they love to talk about it, especially with their peers. This natural tendency to want to tell others about an enjoyable experience can be used as a catalyst to encourage writing. I point out to students that when they write about their work, they are behaving like scientists because whenever scientists make a new discovery, develop a breakthrough procedure, or invent a new device, they write a paper explaining what they have done. When this paper is published in a scientific journal, their peers have an opportunity to make comments and supply valuable feedback.

To make my students' writing experience even more authentic, I try to find publishing opportunities for them. I have had success with *Dragonfly*, a science magazine from the National Science Teachers Association for upper elementary and middle school age students, that publishes student-developed experiments, investigations, stories, artwork, and poems. Recently, I learned that *ENC Focus* publishes student essays about their learning in science and mathematics.

As a class assignment I asked my students to choose a successful science activity or project that they really enjoyed. They were to write a feature article for *Dragonfly* or *ENC Focus* about that activity. Topics ranged from units on electricity to interesting science fair projects to student-developed web pages.

I reminded them to write in a clear style, and to explain any difficult terms that they used. They were to design an attractive layout that included a headline title, drawings, cartoons, illustrations, and/or photos.

Prior to the assignment, my students examined articles written in scientific journals and the feedback that the authors had received, which is usually published in the Letters to the Editor column. Students also worked with our school's English department, examining feature writing techniques and using word processing equipment.

As an extension activity and to reinforce the concept of peer review, students were encouraged to post results of experiments, projects, or other research over the Internet on their own web pages. We made use of Internet domain hosting services and URL redirecting organizations that offer free web space and email services. These web space providers often offer simple web page making tools that are easy for students to use. A dedicated email account can also be set up for students so that they can receive email related to their web pages. You can visit the web page developed by my students at: www.homestead.com/cyberlab3

Michael J. Calhoun, writes science lessons, develops web sites, and conducts after-school science enrichment classes and summer camp programs for upper elementary and middle school age children. He also teaches middle school science at St. Stephen's & St. Agnes School of Alexandria, Virginia.

ENC Celebrates Your Students

"What's wrong with our schools" is a prominent topic, especially in an election year. But teachers tell us that they wish that someone would focus on what is right: the wonderful young people who grow in so many exciting ways right before their eyes. This is the first in a series of features showcasing the learning that happens every day in schools all over the country.

You can take part in this effort by sending student work that demonstrates their involvement in mathematics, science, and technology. As is illustrated in this first article, the submission needs to include a brief introduction written by the teacher. Student artwork increases the likelihood of publication, but we can return it only if you provide a self-addressed, stamped envelope of adequate size. Please be selective; students can help evaluate their peers' work and choose the best for submission.

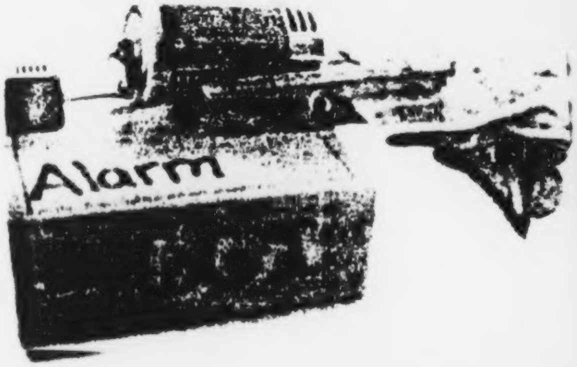
Submit electronically by attaching files to email:
athorson@enc.org
Or mail to:
Editor, ENC Focus
1929 Kenny Road
Columbus, OH 43210-1079

For general guidelines on writing for *ENC Focus*, see page 22.

Student Writing

Here are excerpts from Michael Calhoun's middle school students' articles. The artwork is also their own. We begin with a few pieces about creating a burglar alarm.

BMMMMM GOES THE BURGLAR ALARM
by Isabel Figueroa



...What better way to learn the steps and procedures of building electronic devices than to have a hands-on activity enabling students to create our own working devices. During the work process, we also learned the schematic symbols to the materials we were working with and many others. Terms such as potentiometer, L.E.D., diode, semi-conductors, insulators and conductors became frequent words in our vocabulary. Learning the terms, uses and material names helped us have a better understanding of our own working model....

There was a variety of burglar alarms we could choose from and construct. The most popular one was an alarm where we put a card in between the switch (preventing the two metal pieces from touching and making the buzzer sound) and punching a hole in the card. We would then attach a string and tape it to the opposite door frame. If a "burglar" then came and tried to step through the door, they would pull the card out and waken someone with the buzzer sound. HAHAHAH! Gottcha ya' bad guy! (Instead of a card, I put money in the clothespin because I have some very greedy siblings!)

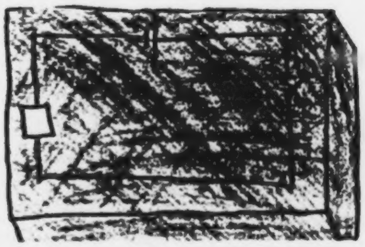
MAKING AN ALARM by Katie Schroeder

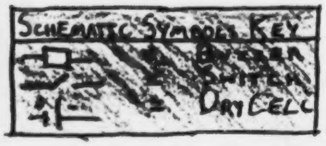
After commenting "You never know when you will need to catch a trespasser!" and listing the materials, this student focused on describing the circuit that makes the alarm work:

In order to make the alarm, you need to know how to wire a series circuit. A series circuit is a circuit consisting of only one path for current to flow. In this case, the series circuit is made up of the buzzer, the dry cell, the clothespin and the paper fasteners. First the paper fasteners are drilled into either side of the clothespin. Then the clothespin, the buzzer, and the dry cell are attached to the block of wood. Once they are all wired together, it is easy to see how the series circuit works. The electricity from the battery goes through the buzzer, and then goes through one paper fastener in the clothespin to the other paper fastener and then back to the battery. You will know if you wired it properly because you will hear the alarm buzz. Putting a piece of paper or a note card between the two paper fasteners will stop the alarm because it will break the circuit.

BURGLARS BEWARE!
by Joe Trunzo

After describing the materials and steps in making the alarm, this student admits:





I experienced success in this project but not on the first try. I thought I had constructed the alarm according to the directions, so when I pulled the string, I was bewildered not to hear the alarm. I looked at my work and asked my teacher for some help. I realized that I had soldered the wire to the wrong end of the dry cell. I cut the wire and re-soldered correctly. Success at last! My hard work was rewarded with an obnoxious buzz.

BUZZ INTO ELECTRONICS by William Schafer

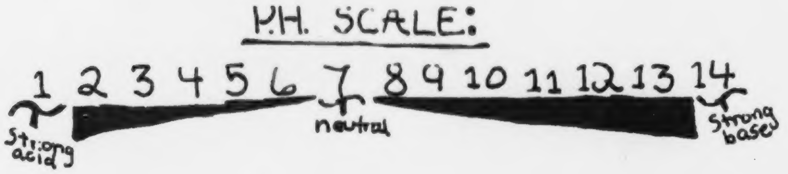
Before launching into detailed directions for making the alarm, this student explains how he measured his success in the real world:

The most interesting and successful activity that I did in the Electronic Unit was to make an alarm system. I have always liked electronics, and I have soldered many times in the past. I have made my own radio and several robots, and I have soldered the electronics for my train. This alarm project, therefore, was right up my alley. I put my finished alarm to use protecting the door to my bedroom. The success of the project was confirmed when my dog tripped over the fishing line and set off the alarm, letting me know that he had entered my room.

ACIDS, BASES, AND NEUTRALS by Lindsay Wright

This student realizes that science is interesting, fun, and "meaningful in daily life!"

...The main indicator I used for this experiment is called litmus paper. This turned a specific color for each level of acid, base, or neutral (contains neither an acid or a base). Also, I learned that there is a chart called a pH scale that measures the strength of the acid or base. As you can see in my diagram, the neutral is in the center, and the strength grows as the acid or base goes farther from the neutral.



In the first part of this experiment, I tested a variety of normal household substances like Alka-Seltzer, soda, Crisco, and hydrogen peroxide. I found out other things about these substances. For instance: Crisco is an acid, and acids taste mostly sour and react with metals more easily than a base. Alka-Seltzer is a weak base that tastes really bitter and is slippery when dissolved. Finally, I found out that there are a lot more common acids than neutrals or bases. One of the only neutrals that I tested is hydrogen peroxide....

I never knew that a simple experiment like this could be so interesting and fun. It seems so unimportant until you investigate further and realize that acids and bases are useful and meaningful in daily life!

HOW TO MAKE A HOME-MADE FIRE EXTINGUISHER

by Margarita Jennings

Safety was on this student's mind as she described this activity:

The best science experiment I have done in my science class was making a homemade fire extinguisher.... The materials I used for the experiment were:

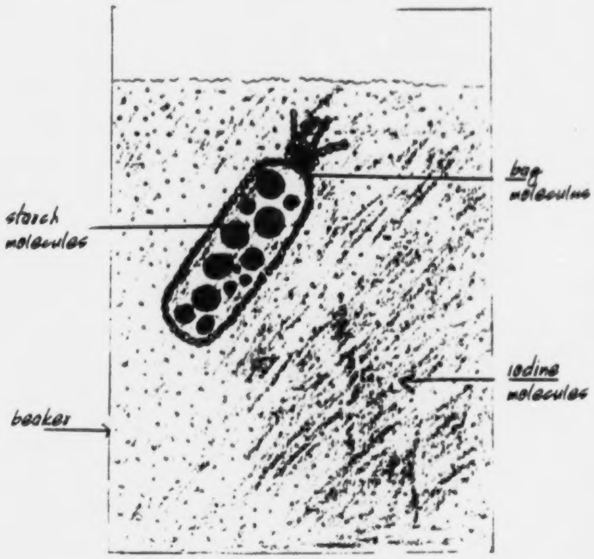
- One tissue (i.e., a Kleenex)
- A rubber band
- One 20-ounce soda bottle (any kind will do)
- White vinegar
- Baking soda
- A cork
- A glass tube
- A propane torch

I melted the glass tube because it was too long. You need about a six-inch piece. I did this by using the propane torch. Be careful! Next, I drilled a hole through the cork. It is important to do this very carefully because corks can break easily. Then, I inserted the glass tube through the hole. Then, I set aside the glass tube and cork and filled my 20-ounce soda bottle about halfway with 10 ounces of vinegar. Then, I took the tissue and put a spoonful of baking soda in it. I used a rubber band to secure the tissue to the glass tube, and then carefully pushed the cork into the mouth of the bottle. I made sure the glass tube was in the tissue so that when the vinegar came into contact with the baking soda, it would make a chemical reaction. Now, I was ready for the real test. Shaking the bottle causes the baking soda and vinegar to mix. This produces a chemical reaction in which carbon dioxide gas is created—the same gas that puts out fires. Carbon dioxide puts out fires by depriving the flame of oxygen. The experiment was successful because I followed the directions and worked carefully. It is important to do this with adult supervision.

MOLECULES by Cassie Griffin

Here's an essay that shows development of understanding of one of the big ideas of science.

Of the many experiments that we do in my science class, the most interesting one was where we proved that molecules exist. First we took a beaker and filled it with iodine. Next we took a special kind of plastic bag, filled it with a starch solution, and tied a knot at the top of it. Then we took the starch solution-filled bag and placed it in the iodine-filled beaker. The moment the starch solution-filled bag touched the iodine, the white solution turned blue. It did this because the starch molecules were big so they couldn't get out of the medium-sized molecules that made the bag. The iodine molecules were so small that they could get into the bag and turn the solution blue, but the solution's molecules couldn't escape so they couldn't turn the rest of the beaker blue. I think that this experiment was successful in two ways. It worked, and it taught me that molecules do exist.



WEB PAGE by Mollie Woods

This student realizes that Internet users like "a little entertainment" along with their information.

...My web page is about the element Nickel, which I researched and then wrote a research paper on. We had to find out the atomic number, mass number, atomic symbol, and many other concepts about the element. On the web page I included some of these concepts and a few pictures to add a little entertainment. Through this web page, I have shown people what I learned about the element Nickel. If you would like to view my web page and a few of my classmates' pages, go to www.homestead.com/cyberlab3/. You can find all of the elements on the periodic table.

JUMP ONLINE!
Connect to all the web sites mentioned in this magazine via the online version
enc.org/focus/realworld

Focus on Mathematics and Science in the Real World

Real-World Learning: A Necessity for the Success of Current Reform Efforts

This leader in science education reminds teachers that all children start out full of curiosity and questions about the world around them. Fostering this in the classroom is an important challenge.

Robert E.Yager, University of Iowa, Iowa City

Mathematics and science are creations of the human mind and, as such, are continuous enterprises. Unfortunately as mathematicians and scientists accomplish more, information and skills advance to the point that transmitting them to the youth of a given culture during a K-12 education becomes impossible.

Many still try, but debates intensify as to which concepts and which skills need to be transmitted and in which order. Educators want school mathematics and science to include the major ingredients of these disciplines. They also want all youngsters to know this material. But few youth succeed and fewer still see the relevance of the study to their own lives.

The national standards for mathematics and science education urge school programs to deal with content that is relevant and that can be used in daily living. Nonetheless, too many educators and community members see this effort as an "add-on" (i.e., something to be done after studying and learning basic concepts and skills).

In a 1998 NRC publication, Carl Sagan is quoted as saying that all children start out as scientists, full of curiosity and questions about the world around them. Typical school programs destroy this curiosity before middle school. Most students stop studying mathematics and science as soon as they are allowed to do so. Part of the reason is that few see any relationship between their study and their daily lives and/or any likelihood that their study will benefit them in the future. Even those who excel in the coursework seem to learn only as preparation for further study.

Robert E.Yager is Professor of Science Education at the University of Iowa. In his distinguished career, he has led seven national organizations and is currently president of the National Association for Science, Technology & Society. He has directed more than 100 staff development workshops and institutes, most of them funded by NSF, and has authored more than 500 research reports, monographs, books, and project proceedings. Email: robert-yager@uiowa.edu

Simpson (1963) defined science (broadly conceived to include mathematics) to consist of four facets:

1. wondering about and questioning the events and objects in the natural world,
2. offering explanations about the objects and events encountered,
3. designing experiments as a means of collecting evidence to see if the explanations have validity, and
4. communicating the evidence collected to others in hopes that they will agree with the explanation and accept the evidence provided.

These basic ingredients are missing in most school programs.

Since the mid 1980s, we have learned more about learning. We now know that most students do not learn what teachers teach. Instead they retain explanations personally constructed to account for phenomena in the rational universe. Typical school mathematics and science seem unrelated to the real world. The skills and concepts taught are rarely internalized and rarely used. There is a schism between the explanations offered in schools and those accepted and used by students.

The content comprising school programs must be related to the real world of students if it is to be useful. Students must be partners in the educational enterprise. They must be encouraged to practice all four of Simpson's steps. This, in turn, means that classroom practice should reflect the following conditions (Perrone, 1994):

- Students help define the content.
- Students have time to wonder and to find a particular direction that interests them.
- Topics have a "strange" quality—something common is seen in a new way, evoking a "lingering question."
- Teachers permit, even encourage, different forms of expression and respect students' views.
- The richest activities are those "invented" by teachers and their students.
- Students create original and public products; they gain some form of "expertness."
- Students do something—e.g., participate in a political action, write a letter to the editor, work with the homeless.
- Students sense that the results of their work are not predetermined or fully predictable.

This issue of *ENC Focus* provides wonderful examples of how concern for mathematics and science in the real world can lead to educational reform and exemplify the visions in our current national standards.

References

Perrone, V. (1994). How to Engage Students in Learning. *Educational Leadership*, 51(5), 11-13.

Sagan, C. (1998). *Every Child a Scientist: Achieving Scientific Literacy for All.* Washington, DC: National Research Council (NRC) National Academy Press. www.nas.edu

Simpson, G.G. (1963). Biology and the Nature of Science. *Science*, 139(3550), 81-88.

EXPLORING SCIENCE THROUGH THE GLOBE PROGRAM

Elementary students are not too young to join older students in providing scientific data that inform Internet users all over the world.

by Kay Berglund, Science Teacher, Bethesda, Maryland

At Norwood School, our science classes move into real-life learning when students gather outdoor environmental data and use the World Wide Web to report this data to scientists and other students. Through our involvement in the GLOBE (Global Learning and Observations to Benefit the Environment) program, we join students around the world to measure water temperature at a nearby stream or to track changes in the weather from day to day.

In more than 85 countries all over the globe, students and teachers are gathering this sort of data and submitting their findings to a growing database on the Internet. Scientists and other students access the data for research about the global environment. As a science teacher, I have found this program to be a terrific way to get students excited about science and to help them contribute meaningfully to a worldwide science venture.

Getting Involved with GLOBE

I first learned about the GLOBE program through their web site (www.globe.gov). I attended a free workshop where GLOBE trainers and other teachers taught me how to collect data about the water, soil, atmosphere, and land around our school.

I learned, and later taught my students, that we need to take these measurements as carefully as one of the scientists would if he or she were to visit our creek or hilltop. We learned how to follow very specific protocols (sets of directions for how to take these measurements) so that our data can be compared to data from other schools around the world.

Scientists who need data for their research on soils, global warming, or water quality designed these protocols for use anywhere, from urban Washington, DC, to the deserts of Africa to the ice of Antarctica. The data that students submit are used by these scientists and have also been accessed by other scientists who need information they cannot gather themselves.

WINNER of ENC's Digital Dozen Award

GLOBE: GLOBAL LEARNING AND OBSERVATIONS TO BENEFIT THE ENVIRONMENT

Vice-President Al Gore started GLOBE five years ago in a non-partisan effort to gather environmental data that can help to resolve questions about global warming and other world environmental issues. Using the ability of schools to touch every corner of the world, GLOBE aims to gather vast amounts of environmental data and to increase students' sense of the world as a whole, rather than as independently functioning countries. The program illustrates how complex environmental issues can be resolved by learning more about them, instead of by political grandstanding.

Teachers in more than 8,000 schools around the world are involved with GLOBE. Participants range from elementary youngsters through college and even graduate-level students. GLOBE participants form a powerful Internet community, as students and scientists work together to gather environmental data that can help everyone understand our world environment better.

For more information, visit GLOBE's web site at www.globe.gov, or call 1-800-858-9947. You can also link to the site via the online version of the magazine, enc.org/focus/realworld/

Observing our Neighborhood as Scientists

For our first venture, the whole fourth grade class visited our nearby stream and learned how to measure the pH, temperature, conductivity, and dissolved oxygen content of the water. We also used a Global Positioning Satellite receiver, on loan from GLOBE, to identify our latitude and longitude and find out exactly where in the world our creek is located.

When we returned to the classroom, we averaged the values we had measured, looking critically to be sure that our data made sense. Then we used our school ID and password to log in to GLOBE's web site so that we could enter our data for that day.

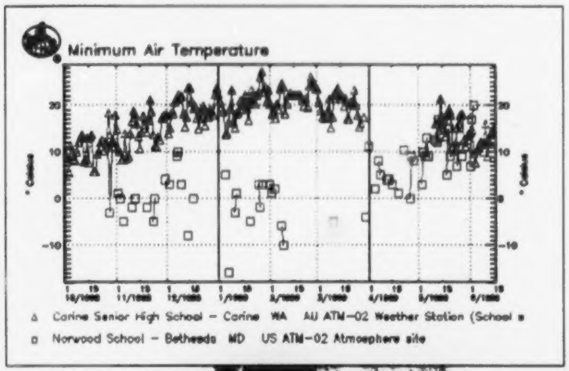
A group of students returns to our creek every couple of weeks to take the same kinds of measurements about our water. We enter our data into the web database each time, and after a few visits we had enough data to be able to pull up a meaningful graph of the conditions of our creek water. We found, for example, that the oxygen content of our water was much lower in the fall than a few months later; we hypothesized that this might be because all the leaves decaying in the water consume oxygen.

Kay Berglund teaches elementary science at Norwood School in Bethesda, MD. She is currently on a year's leave of absence from Norwood, while she pursues a graduate degree at Teachers College, Columbia University

We have provided several different kinds of data for the GLOBE project, including measuring information about the types of trees we have near our school and how our land is used.

Our most faithful recording is our daily measurement of the weather conditions at our school. Each day at noon, a pair of students visits our weather shelter, where they record any rain in our rain gauge, use a maximum/minimum thermometer to track the daily temperatures, and look at a cloud chart to determine the type of clouds. This cloud chart is written in six different languages to accommodate some of the languages of other students around the world who take the same measurements we do.

When we studied the seasons, we used our data on the web site to create a graph comparing our seasons to those of a school in Australia. We also could see the difference between seasons in the northern and southern hemispheres. (See graph.)



Expanding Student Horizons

We have also participated with GLOBE in ways that have extended beyond a conventional science class. Because GLOBE is international, we have learned a great deal about geography and latitude and longitude, as we pull up maps to help us find schools with interesting data. Through the web site, we can email other schools involved with GLOBE, whether they are in Africa, Eastern Europe, or South America.

During hurricane season last spring, we participated in a Hurricane Preparedness web chat with schools as far away as South Carolina, Texas, Argentina, and Greece. This was my first attempt to participate in a web chat with a group of students, and it was wonderfully successful.

My students were interested and engaged, and they were eager to ask their own questions of the NOAA experts hosting the chat. The first hour of the chat was in English, but the second hour switched to Spanish. When our English-speaking students were frustrated at their limited ability to participate in the second hour of the chat, their desire to be able to communicate in a foreign language skyrocketed.

Getting started with GLOBE is a terrific avenue for any school in the world to use technology in a way that is rich and fulfilling. Ten years ago, before the Internet was available to us all, such a worldwide effort would not have been possible. Today, GLOBE's presence, through schools like ours, spans all seven continents. Students everywhere have an opportunity to contribute meaningfully to a constantly growing pool of data about our world environment. ●

Writers' Guidelines for *ENC Focus*

GUIDELINES FOR CONTENT OF ARTICLES

ENC publishes print and electronic materials on specific topics of interest to teachers of K-12 mathematics and science. Articles submitted for consideration should be grounded in the national educational standards while being short (500 to 2,000 words) and compelling. It is essential that articles promote educational equity and advance of the principle of "education for all."

We particularly invite teachers to write about their classroom experiences, using first person and a conversational tone. Please note that library research papers written in academic language for graduate school courses are unlikely to be selected for publication. We do, however, encourage you to include a few, carefully chosen references or a brief reading list. All content must be original, and all quotations must be properly cited.

We also publish essays by K-12 students about their successes in mathematics and science. Teachers are encouraged to assist students in writing and submitting materials for publication.

ENC is not interested in publishing articles that have the main goal of promoting commercial products.

GUIDELINES FOR PHOTOGRAPHS AND ILLUSTRATIONS

Photos or other illustrations add interest, and good illustrations increase your chances for publication. Photos should show students involved in an activity rather than looking directly at the camera. Students in laboratory settings must be shown following appropriate safety guidelines and wearing proper safety attire, including eye protection. Please select photos that depict diverse students and teachers working together.

Please note that we can use photos of children under 18 years of age only if we receive written permission signed by a parent or guardian. It is important that the form specify that permission is granted for use of the image on the Internet as well as in print. ENC will provide permission forms on request.

Photos, slides, negatives, drawings, or charts may be mailed to the editor. We prefer color, but black and white photos are also acceptable. Photos should be at least 4x6 inches. Tape an identifying label on the back of each item rather than writing on it. Photos and other illustrations or materials will be returned only on request. Keep in mind that we will not be able to return any material until after the magazine is printed.

If you would like to use a digital camera, please take photos at your camera's highest setting, which may be 1024x768 or 1240x960. You can then attach those photos to an email or send them to us on a disk. Scanned images need to be at least 300 dpi; the dimension of the image should be at least 4x6 inches. Save the images as jpeg files. Digital photos printed on photographic paper with an ink jet printer are not acceptable because the resolution is inadequate for reproduction.

SUBMISSION DETAILS

Authors of unsolicited manuscripts are urged to send a brief proposal via email well in advance of the deadline for the upcoming topic. Proposals should explain how the article fits the topic and how it serves the needs of K-12 teachers. Future topics and deadlines are regularly published in both the print and online versions of the magazine.

We prefer that manuscripts be submitted electronically. A Microsoft Word or text file attached to an email message works well. Manuscripts can also be submitted by fax or regular mail. Paper submissions must be typed in a large, clear font; this is especially important for those sent by fax.

Each manuscript must be accompanied by the full names, postal addresses, telephone numbers, and email addresses of all authors. In addition, each author must be further identified with one or two sentences providing the author's professional affiliation and background.

We cannot consider manuscripts that have been submitted elsewhere. Occasionally we reprint outstanding articles that have been previously published. Authors suggesting their own articles for reprint must provide written permission from the original publishers.

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THE EDITING PROCESS

Your proposal or manuscript will be acknowledged as soon as possible after it is received. Inclusion of your email address greatly speeds this response.

Please keep in mind that just because an article has been acknowledged does not mean it has been accepted for publication. Sometimes we cannot determine whether a particular article will be published until all articles for the issue have been edited.

All articles, solicited and unsolicited, are reviewed by ENC's mathematics and science education experts both before and after they are edited, and edited articles are reviewed by officials at the US Department of Education. At any step in this process, ENC reserves the right to decline to publish any article, to delay publication until a later issue, or to publish an article online and not in the print version of the magazine.

During the editing process, you may be contacted to answer questions about your article. Or you may just receive an edited version of your article for your approval. At this point we need an immediate response, even if the article is correct to print as edited.

Please keep in mind that articles may be changed significantly to suit the needs of our audience, to match our style, or to fit in the space available. We want the edited version to be factually correct and to express your views accurately, but ENC retains the right to make final editing decisions.

WHEN YOUR ARTICLE IS PUBLISHED

ENC mails five copies of the print version of the magazine to each author. Requests for bulk shipments of the print version will be filled while supplies last.

Upcoming topics and deadlines are listed on page 5.

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COCKATIELS TO KITTENS:

Animal Behavior in the Real World

This informal education specialist offers suggestions that can easily be adapted for use in a variety of classroom settings.

by Leah M. Melber, Natural History Museum of Los Angeles County, California

INQUIRY INVOLVES...

- **Making Observations**
- **Posing Questions**
- **Examining Information Sources (books, etc.)**
- **Planning Investigations**
- **Gathering, Analyzing, and Interpreting Data**
- **Proposing Answers and Explanations**
- **Communicating Results**

—National Science Education Standards (1996, p. 23)

When asked what they know about how animals behave, most students are likely to describe snarling tigers or herds of antelope. What youngsters often do not realize is that they can observe animal behavior right in their own homes.

From tanks of fish to a brand new puppy, the animals we have come to love as pets are a living laboratory waiting for students to discover. Pet investigations are one way for students to gain a better understanding of animal behavior; the activities also encourage students to see connections between familiar household pets and their wild relatives. Through investigation and inquiry, students will make these connections and discover that science is all around them.

Perhaps the most exciting thing about pet investigations is that students don't need to have their own pet to take part. They can plan on visiting a relative's cat, walk by a "dog park," or take a trip to an aquarium shop. Plus, many teachers maintain an aquarium or cages with small animals in their classrooms.

Science Is for All Students

The National Science Education Standards (National Research Council, 1996) stress that students should "experience the richness and excitement of knowing about and understanding the natural world" (p. 13). In addition, the standards emphasize the principle that "science is for all students" (p. 20).

For many students, however, the natural world is limited to what can sprout between cracks in the school asphalt. Using domesticated animals as a scientific topic is a way for all students to conduct independent investigations and experience the richness of nature. Through pet investigations, students will participate in the different steps the national standards identify as components of the inquiry process (see box on this page). From making observations to analyzing data, students will be conducting real-world scientific investigations on personally relevant topics.

Preparing Student Scientists

Preparing students for pet investigations is an exciting process. You may want to begin by sharing a film clip of biologists in the field or by looking at issues of nature magazines. A class vote on what type of pet the students think is the most fun for a family to own is another way to stir interest.

Introduce youngsters to the idea of becoming Student Investigators by explaining that studying household pets is much like the work of wildlife biologists. Letting them know they will be directing most of the project is an excellent way to empower students. Keeping the project student-centered also reinforces the idea that student interests are academically important.

Leah Melber is the science education specialist at the Natural History Museum of Los Angeles County. She has degrees in education and zoology, has been a classroom teacher, and is currently working on a doctorate in educational psychology. Email her at lmelber@nhm.org

Student Investigations: Making Observations and Collecting Data

The first stage of the investigation is based solely on observation. Work with students to decide what kind of domesticated animal they would like to study. Watching dogs at the park, horses in the field, or fish in a bowl are just a few examples. Two students may want to study the same pet or each student may want to do a project individually. Try to be as flexible as possible at this stage.

Reinforce the idea that students do not need to be a pet owner to participate in the project. Also reinforce animal safety and the need to be extra cautious around pets that do not belong to the student.

Once students have selected an animal, have them spend some unstructured time observing and making notes about what they see. They will then rely on these notes to pose questions for an investigation. For younger students or those who may need more assistance in selecting questions to explore, you may want to provide some of the following suggestions:

- Provide your cat with a toy and watch it play. How is the way it plays similar to how a wild cat hunts? Does it prefer to use one paw over another?
- Visit a park to watch dogs interact with each other. What body language do you notice when they greet each other? Do their tails or ears change? Is one dog more active than the others?
- Watch how a bird cleans or 'preens' its feathers. Does it preen certain areas more than others? If two birds live together, can they be seen preening each other?
- Spend some time watching a fish tank. Do some fish prefer certain areas of the tank? What patterns can you discover?
- Visit a barn and watch the horses interact with each other. Can the way they move their ears provide you with clues on how they feel about each other?

Data Analysis: Identifying Patterns and Drawing Connections

After students have selected a focus for their project, have them conduct more observations and carefully record information specific to their focus. You may provide young children with a form or checklist to facilitate their data collection. Older students may simply be asked to create a "field journal."

Make sure you allow enough time for students to conduct more than one investigation. It is a good idea to include at least one weekend in case students need to go outside their homes.

Once students have observed patterns of behavior with domesticated animals, it is time for them to analyze their data and think of possible reasons for the patterns they see. Most animals exhibit behaviors that can be linked to their wild relatives. Help students begin to think that way by providing an example. You might mention that the way dogs interact with each other is much like the way members of a wolf pack communicate. Some wild birds spend hours preening each other as an important part of social interaction. Wings may get special attention since they are important for flight. Fish that select specific sections of a tank reflect the ecosystem of a stream.

After providing students with one of these examples, encourage them to locate information related to their investigation on their own. Children's nature magazines and books are good sources to begin with. The Internet is also a great place to look. (Sidebar on the next page provides a list of print and web resources related to this topic.) Encouraging students to find and use information sources not only teaches them the skill of research, but also allows them to broaden their interests through exposure to new ideas surrounding the question they are researching.

Drawing Conclusions and Sharing Discoveries

Once students have conducted their investigation and made sense of the information they have gathered, it's time to share what they have learned with their classmates. Reports or oral presentations are traditional ways to present information in the classroom, but scientists regularly employ other means to share their discoveries. Perhaps your students may want to try one of these alternatives:

Scientific Conference

Have students create poster boards and displays outlining their project discoveries. Invite other classes to visit and speak with students about their projects. Students can also create PowerPoint presentations. Invite a local veterinarian as a guest or keynote speaker!

Scientific Journal

Have students create a magazine containing all of the different projects and their "findings." They may decide to add photographs or line drawings of the pets that were studied. "Publish" the journal and share copies with parents, students from other classes, and the school library.

Home Extensions

Encourage students to continue their pet investigations beyond the assigned project. Perhaps one of the most beneficial outcomes of this project is that it provides students with a better understanding of why our animal companions behave the way they do. As students discover the complexities of the behavior of even the most common household pets, they become more aware of the science that surrounds them everyday in their homes and communities.

Reference

National Research Council. (1996). *National Science Education Standards*, Washington, DC: National Academy Press.

Resources About Pets

Selected and annotated by Lynda Titterington, ENC Instructional Resources

Videos:

- The Salamander Room. This Reading Rainbow video features a book about a little boy who adopts a pet salamander and learns that there is more to creating an animal habitat than meets the eye. A teacher's guide provides related activities. [Grades 1-4] ENC-005740

- Newton's Apple Program 1504. This video program presents a series of segments on pet animals that include how to select a healthy pet and how scientists develop quality dog and cat food. Other segments examine dog behavior and debunk some commonly held misconceptions about animals. A teacher's guide provides related lessons and activities. [Grades K-12] ENC-014716

Books:

- *Adios, Chi Chi.* When Maria moves to New York City from New Mexico, she discovers a large tarantula stowed away in her suitcase. The story describes how Maria cared for the spider until she could return it to its natural habitat. [Grades 2-4] ENC-004597

- *Why Does the Cat Do That?* Why do cats scratch the walls and present their owners with gifts of dead mice? This picture book describes how domestic cats retain many of the instincts of their wild ancestors. [Grades 1-5] ENC-016580.

- *Dog's Best Friend: Annals of the Dog and Human Relationship.* These anecdotes and observations explore the special relationship between humans and dogs. Through the insights of trainers and handlers who understand the canine mind especially well, readers learn how the knowledge of a dog's natural behavioral patterns can enrich and protect the lives of both dog and trainer. [Grades 9-12] ENC-016226

- *Mealworms.* Part of the Life Cycles series, this book follows mealworms as they complete a cycle of metamorphosis. Readers also learn how to design an experiment to test mealworm's reactions to light. [Grades 1-5] ENC-015412

- *More Pet Bugs: A Kid's Guide to Catching and Keeping Insects and Other Small Creatures.* Written by a former science teacher, this book answers kids' questions about bugs. It also helps them discover their own answers through observing insect behavior. Readers learn what each bug looks like, where to find it, how to catch it, and how to take care of it. [Grades 3-6] ENC-014775

- *My Pet Rat.* In this book, 12-year-old Rachel describes her experiences as she learned to care for her pet rat Kirby. The book includes instructions for building a race track, as well as a listing of rat fanciers' clubs. [Grades 2-8] ENC-016118

- *Parrots and Parakeets as Pets.* This book for young readers discusses what to consider when selecting a parrot or a parakeet for a pet. Other books in the series describe how to care for tropical fish, iguanas, and gerbils, as well as cats and dogs. [Grades 3-5] ENC- 015950

Web Sites

- The Use of Animals in Biology Education. www.nabt.org/Animals.html presents the position statement of the National Association of Biology Teachers (NABT) in support of the prudent and responsible use of animals in the life science classroom. [Grades 7-12] ENC-010895

- The Electronic Zoo. netvet.wustl.edu/e-zoo.htm presents a comprehensive listing of care sheets and other resources about animals, domestic and exotic, from amphibians to small ruminants. [Grades K-12] ENC-008638

JUMP ONLINE!

Link to ENC records for all these materials via enc.org/focus/realworld

MATHEMATICS PROJECTS THAT FOSTER A CRITICAL LOOK AT OUR WORLD

Using real-life investigations, this seventh grade teacher motivates her students to critically examine the world around them, helping them become quantitatively literate or "numerate."

by Fanny Sosenke, Mathematics Teacher, Indianapolis, Indiana

As a middle school math teacher, I believe my job goes beyond teaching the mathematics skills and concepts that will prepare my students for the next math class. I want to make sure that the curriculum my students are exposed to: "represents significant, powerful mathematics for all students; emphasizes topics that are relevant to students' present and future needs; and emphasizes the full use of such tools as calculators, computers, ... for making sense of and doing mathematics." (Lappan, 1999).

Ultimately, I hope my students will use the math they learn in my class to better understand the world in which they live and work. I designed the following open-ended projects to help attain this goal. In each of them, students need to use mathematics, technology, and critical thinking in real-world situations to analyze data and make decisions.

Students must have some basic spreadsheet skills and know how to navigate the World Wide Web to complete these projects. Some projects require local or toll-free telephone research. I often expand the technology requirements of these projects by sending the assignments to the students in email messages. To evaluate the students' work, I create a rubric for each project; often I ask students to evaluate their own work or the work of their peers. See Evaluation Sheet for Project 1 (page 27).

REFERENCES

Dudley, U. (September/October 1998). Numerology: Comes the Revolution. *Skeptical Inquirer* 29-31, 59.

Lappan, G. (November 1999). Revitalizing and Refocusing Our Efforts. *Journal for Research in Mathematics Education* 30, 568-78.

Fanny Sosenke teaches seventh grade math at Park Tudor School in Indianapolis; she also teaches math teaching methods and elementary mathematics courses for preservice teachers at Indiana University-Purdue University at Indianapolis. She has given workshops and presentations on mathematics education and technology at various conferences, including workshops in Uruguay, her country of origin. Sosenke received the 1997 Presidential Award for Excellence in Science and Math Teaching.

PROJECT 1: COST OF LIVING COMPARISONS

Your current salary in Indianapolis is $30,000 a year. You are planning to move to a city in another country of your choice. What would your salary have to be in your chosen country to equal $30,000 in US currency? How do the salaries in each country compare with the cost of a newspaper in the respective countries? How do the salaries in each country compare with the cost of a Big Mac? (See The Big Mac Index on p. 27.) Can you analyze the differences? What would your salary have to be in your chosen country for you to maintain your current standard of living?

Steps:

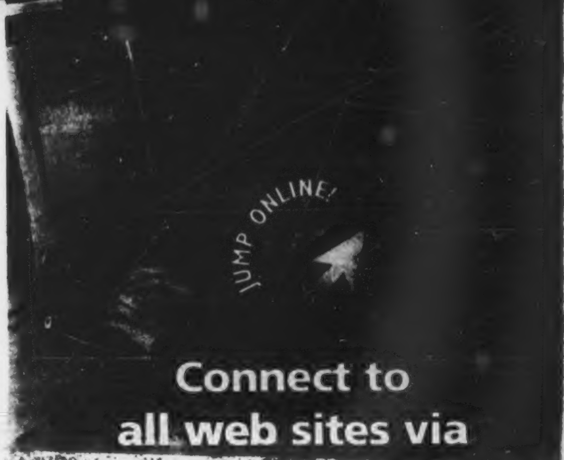
1. Choose two foreign countries to investigate; you will also need to do research on the United States for comparisons.
2. Find out equivalent salaries in the countries using this web site: The Salary Calculator from Homefair.com (www.homefair.com/homefair/cmr/salcalc.html)
3. Find out the cost of a newspaper and the cost of a Big Mac in the countries. (While you may have sources to help students find this information on their own, I have compiled data on these costs for several countries. See the Cost of Living Table in sidebar on p. 27.)
4. Determine the currency exchange rates for the chosen countries at either of these web sites: www.oanda.com/converter/classic or www.x-rates.com/tables/USD.html
5. Create a spreadsheet:
   INPUT:
   - Country
   - Salaries (Note: the web site has the salaries in dollars.)
   - Exchange rate
   - Price of a newspaper in local currency
   - Price of a Big Mac in local currency

   OUTPUT:
   - Price of a newspaper in dollars for each country.
   - Price of a Big Mac in dollars for each country.
   - Ratio of your salary in the foreign country to your U.S. salary.
   - Ratio of the price of a newspaper in a foreign country to the price of a newspaper in the U.S.
   - Ratio of the price of a Big Mac in a foreign country to the price of a Big Mac in the U.S.
6. Write a half-page to one-page conclusion based on your results. In the report you will state your opinion on the relationship between salaries and the cost of a newspaper and a Big Mac. Some questions you should answer in your report (but not the only questions you should answer) include:
   - Do you think it's cheaper to live in your chosen countries than in the United States?
   - Are there differences between the salary, newspaper, and Big Mac ratios?
   - Why are there differences between the ratios?
   - Does the price of a Big Mac say something about the cost of living in a country? What about the price of a newspaper?

The Big Mac Index

The Economist has published the Big Mac Index for 13 years. They use the price of a Big Mac around the world to analyze the purchasing power of local currencies and to predict, in a light-hearted way, where particular currencies may be headed. You may wish to do some reading to help students discuss this issue critically. See the articles at

www.economist.com/editorial/freeforall/focus/big_mac_index.html


JUMP ONLINE!

Connect to
all web sites via
enc.org/focus/realworld

Data for Project 1:
Cost of Living Comparisons

Prices are in the country's currency.

Country	Sunday Paper	Daily Paper	Big Mac
Ireland	1	0.3	2.81
England	1	0.3	2.43
Costa Rica	150	80	600
Spain	275	125	375
Canada	2.01	0.66	2.99
Thailand	8	8	52
Ecuador	40000	40000	35860
Germany	2.5	1.3	4.95
Israel	7.8	3.6	13.9
Australia	1.7	1	2.65
Italy	2500	1700	4500
Uruguay	25	17	40
China	3.5	3.5	9.9
France	6	5	17.5
U.S.A.	1.75	0.35	2.43
Hong Kong	7	7	10.2
Mexico	5	10	19.9
Japan	160	160	294
Chile	300	500	1,250
South Africa	4.9	2.3	8.6
Netherlands	—	2.5	5.45
Brazil	2.5	1.25	2.9

(Data collected by Fanny Sosenke, 1999.)

Evaluation Sheet

Cost of Living Project *Name* ______________________

Spreadsheet:

Spreadsheet includes all required information ___/10 points

Data:
- Correct data for exchange rates
- Correct data for newspaper price in local currency
- Correct data for Big Mac price in local currency
- Correct data for salaries ___/10 points

Used correct formulas:
- Formula to get newspaper price in dollars
- Formula to get Big Mac price in dollars
- Ratio of salaries
- Ratio of prices of newspaper
- Ratio of prices of Big Macs ___/20 points

Presentation ___/5 points

Graph:

Graphed correct data ___/10 points
Graph presentation ___/10 points

Report:

Report draws thoughtful conclusions based on the details found in the spreadsheet or graph ___/25 points
Report presentation ___/10 points

Total: ___/*100 points*

PROJECT 2: CHOOSING A LONG-DISTANCE SERVICE

You just moved to the United States from another country of your choice. You need to get a telephone account with long distance service. Since you miss your family and friends back home, you want to call them often. Your project is to select a long-distance service to go along with your regular local telephone account. The class will need to determine as a whole how often immigrants will be calling home and for how long they will speak each time.

Steps:

1. Decide which country you are from.
2. Find out how much it costs to have a telephone in Indianapolis for local calls.
3. Choose the company that will give you the best deal for long distance calls to your home country. You should conduct research with at least three companies before making your decision.
4. Given how often you will be calling home and how long you will be talking, estimate how much money you will be spending on international calls every month.
5. Finally, estimate the total cost of having a telephone for a year.

You need to submit:

- A spreadsheet summarizing your results
- A dated log of your research activities in completing this project
- A summary and conclusion based on your findings
- An evaluation of your work.

NOTE: Any decision will be accepted as long as you have a reasonable justification for making that decision.

PROJECT 3: VACATION PLANNING

For both parts of this assignment you should present your research results on a spreadsheet.

Part I:

Your family is planning a two-week vacation for a year from now. You may choose among the following destinations: Orlando, Florida; Washington, DC; and San Francisco, California. You will get to your destination by car. Your parents have asked you to estimate the total cost of the trip.

Steps:

1. Choose your vacation destination from the three choices.
2. Find the distance between Indianapolis and your city (from www.danagateway.com/mall/travel/drive.htm).
3. Estimate how much money you should budget for highway tolls on a round trip to that city. Explain how you arrived at that estimate. A road atlas will be helpful for these estimates.
4. Your family car can travel about 28 miles on a gallon of gas. About how much gas do you think you will need on a round trip to the city you chose? About how much will that gasoline cost? Explain how you arrived at that estimate.
5. Determine other major expenses for a two-week trip to your chosen destination. Factors to consider: Where will you stay? What will your activities be? Will you be going to amusement parks, museums, national parks? What types of meals will you eat?
6. Estimate the total cost of a trip for a family of four to your vacation city. Show separate estimates for all major expenses. Be sure to show how you arrived at each estimate.
7. Your parents plan to put aside some money for the vacation each month for the next year. What amount do you think this should be? Explain.

Part II:

Your family of four is taking a two-week vacation by car. Your budget is $2,500. Where can you go and what can you do? Choose a city from the three named above that you want to visit– do not use the same one you researched for the first part of this project. You have to spend all your money! Keep in mind all of the factors that you budgeted for in Part I. At the end, your spreadsheet should show all major expenses and how they fit into your budget.

PROJECT 4: CHOOSING A PIZZA RESTAURANT

For this project you will work with a partner. Your task is to research local pizza restaurants to make an informed decision regarding which pizza to buy. Students who receive an A in this project will participate in a pizza lunch!

Steps:

1. Research prices and dimensions of plain cheese pizzas by calling at least five local restaurants that serve pizza.
2. Make a decision regarding which pizza to order. You should take into account the factors that are most important to you—some factors to consider include best buy, quality, and how much you plan to eat. You will need to decide and explain how you define quality and best buy!
3. Make a spreadsheet to present the information you collect.
4. Write a business letter to your teacher that describes the results of your research and convinces her or him what pizza to order for the pizza lunch. Include your own definition of pizza quality and best buy in your letter, as well as any other information you decide is important. Your letter has to be typewritten, and use business letter format.

PROJECT 5: FACTS AND NUMBERS FUN

Did you know that if you look hard enough you can often find interesting facts connected to certain numbers? The mathematics of probability will tell you that amazing things can happen at random.

For this project, you will work in a group, and your group will pick a number and a theme and find unusual instances of the number's occurrence. Be creative—your ingenious minds will find all sorts of amazing connections. Hand in a short report with your number and the facts you have found—you don't have to find more than a few facts connected to your number. Have fun!

Example: Arthur Finnessey (Dudley, 1998) compiled the following interesting facts about the appearance of the number 57 in the American Revolution:

- Four of the first six US Presidents were inaugurated at age 57.
- On a presidential data chart in a particular encyclopedia those four 57-year-old presidents are listed at the top of their columns and surprisingly there is not another age 57 in the remainder of the long list.
- The number of chests of tea that were thrown into the harbor at the Boston Tea party is 6 times 57.
- A few weeks after Lafayette's 57th birthday, Francis Scott Key wrote the *Star Spangled Banner*.
- When Lafayette died, the Declaration of Independence was 57 years old.
- Princeton and Yorktown, Washington's two victories over Cornwallis, were 57 months apart.
- The fateful year of Yorktown began with two battles 57 days apart.
- In June 1781, 57 Americans died in the assault on the British Fort 96 in South Carolina.

WATER ON THE WEB

Internet data on water quality in Minnesota can serve as a basis for real-world science in classrooms all over the country.

Bruce H. Munson, George E. Host, Cynthia A. Hagley, and Richard P. Axler, University of Minnesota, Duluth

WINNER of ENC's Digital Dozen Award

> Thank you for the wonderful data and project.... This project puts symmetry on the year for us. They (the students) have to use the chemistry they know and some they don't know. They have to analyze data. They don't have obvious answers. I tell them I don't know. I tell them to tell me. They have to look at data and figure out how much is necessary. They really wanted to get to the data immediately. The focus and quiet as they delve into the data and resources are great.
>
> —*Ilona Rouda, Chemistry Teacher, The Blake School, Minneapolis, Minnesota*

> I found the Water on the Web site to be of great value and interest to the students.... It was a wonderful source of detailed information and provided the students with access to nearly real-time water quality data. I was able to use the information to devise very realistic problems for the students to work through and discuss.
>
> —*George W. Kipphut, Associate Professor, Murray State University, Kentucky*

> Any science teacher can use the Water on the Web site to help teach water concepts, from water characteristics to complex ecological interactions. It's the next best thing to taking your class to the lake every day of the year!
>
> —*Sue Hutchins, Biology Instructor, Itasca Community College, Grand Rapids, Minnesota*

> Water on the Web is amazing. It has so much to offer. When you are watching the dynamic nature of a lake using the WOW data visualization tools, it is like watching an organism breathe... The lessons and resource materials available through the web site make limnology accessible to all science teachers and students.
>
> —*Charles Goldman, Professor, University of California-Davis*

These are responses of teachers who use Water on the Web (wow.nrri.umn.edu) an award-winning, Internet-based, science curriculum project initiated by funding from the National Science Foundation.

Composed of teachers and scientists, the Water on the Web development team is committed to encouraging students to learn real science through inquiry and hands-on experiences. At the same time, we recognize it is difficult for teachers to get their classes outdoors for field studies as often as they would like. Recent advances in technology provide us with an opportunity to bring water quality studies into secondary science classrooms on a continuing, near real-time basis.

An ever-increasing number of web sites provide science curriculum materials, but Water on the Web (WOW) is unique. It is a dynamic site that provides water quality data, advanced tools to analyze the data, curriculum materials for students and teachers, and a rich body of interpretive materials, web links, and supporting materials.

A Data Hose

The focus for WOW is a constant stream of near real-time water quality data provided through state-of-the-art environmental monitoring technologies. In fact, the scientists involved with the project refer to it not as a "data stream," but a "data hose." Teachers and students turn on the data hose and immediately connect with the real world and real scientific problems.

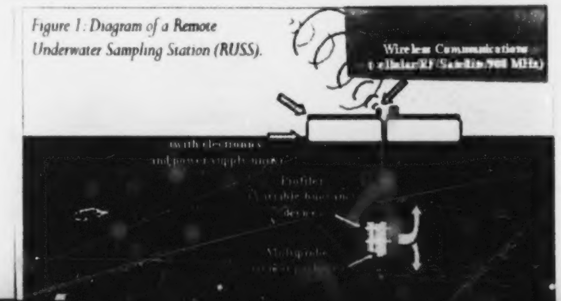
Students and teachers use the site in a variety of ways. Students learn and apply basic science concepts through directed study and inquiry lessons that complement their standard curricula. WOW resources serve as a launching point for self-directed student inquiry into the messy and unexpected water quality relationships found in real, complex environmental systems. Real-time remote sensing technology, GIS, data visualizations, computer-supported data management and analysis, and the Internet make the WOW site a complex, diverse, yet easy-to-use resource.

Remote Underwater Sampling Stations

The technology supporting WOW fascinates many students. The entire site is based on water quality measurements provided by Remote Underwater Sampling Stations (RUSS) units. (See Figure 1.) This patented, advanced-technology remote sensing system was developed at the Natural Resources Research Institute of the University of Minnesota, Duluth, in cooperation with a number of departmental and commercial partners. It is now produced commercially by Apprise Technologies, Inc.

The solar-powered RUSS gathers water quality measurements using a free-floating leveling device and sensor unit controlled by an on-board computer and communications package. The RUSS is programmed to sample at intervals in the water column, providing a water quality profile of the sampled lake. The data are then transmitted back through University of Minnesota computers and posted on the WOW site.

Figure 1: Diagram of a Remote Underwater Sampling Station (RUSS).



The RUSS units currently sample five critical water quality parameters: pH, conductivity, turbidity, dissolved oxygen, and temperature. The data are stored in a variety of ways and can be accessed with a variety of tools, ranging from simple visual inspection of the raw data, to analysis by standard spreadsheet and statistical software, to advanced analytical and visualization tools.

RUSS units are currently deployed in four Minnesota lakes that represent a wide range in size, depth, seasonal dynamics, and other characteristics. (See Figure 2.)

Figure 2: Water on the Web currently provides water quality data from RUSS units in four Minnesota lakes.

Ice Lake is a small (16 ha area, 16 m depth) lake in a residential district of Grand Rapids, Minnesota. Grindstone Lake is located in a rural area and is, in contrast, nearly 50 m deep and supports both warm- and cold-water fisheries. Three RUSS units are located in the suburban Minneapolis region, two in contrasting bays of Lake Minnetonka (thanks to a related grant from the US Environmental Protection Agency EMPACT program), and one in the largely agricultural watershed of Lake Independence. The differences in size and surrounding land use among these lakes provide a unique opportunity to compare and contrast fine-scale temporal dynamics in water quality variables.

WOW Data and Tools

WOW is based on real scientific data. Quality control protocols are used to monitor and maintain the quality of the WOW data. Unlike canned data sets created to support a curriculum, WOW data reflect the realities and complexities of real ecosystems. This means the data often do not fit students' or teachers' preconceived ideas of how a lake behaves.

WOW water quality data are provided in several different formats in the Data section of the web site. Raw data for a lake can be viewed in an archived data set. Weekly data sets can also be downloaded and reviewed in Excel workbooks, which also include graphing templates that assist students in plotting and understanding selected data.

However, for many students it is difficult to see and interpret patterns in numerical data. For this reason, WOW offers interactive data visualization tools. Some teachers use these tools to illustrate trends or relationships among the data. Other teachers have students explore the data using the visualization tools.

The color mapper is an example of one of the WOW visualization tools. The color mapper allows students to view a sequence of lake water quality profiles while exploring the possible relationships between two water quality variables. With this tool, students can see how a line plot superimposes on a color-coded profile.

For example, look at the color profile and plot in Figure 3. Notice how the color-coding reinforces the changes in temperature in the same region that the dissolved oxygen level is changing rapidly. If students understand that gas solubility increases as the temperature of water decreases, the color mapper raises questions for further inquiry.

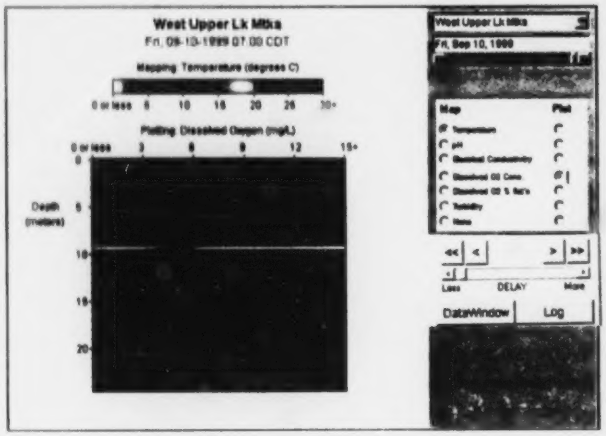


Figure 3: Color mapper display of temperature and dissolved oxygen for a summer day in West Upper Bay of Lake Minnetonka, September 10, 1999 at 07:00 CDT. (Temperatures are color-coded and a line plot identifies dissolved oxygen levels.)

Real Understanding

Students need background information and a context for understanding scientific data. WOW provides an extensive set of resources to aid students in this area. These resources can be found under the heading Understanding on the web site.

In The Lakes section of the web site, students find background information about each lake, its watershed, and its behavior during the period of sampling. This type of information is essential as students make predictions about lake behavior as they explore WOW data.

A Lake Ecology Primer is also included in this section of the site. This material provides a context for understanding water quality parameters and how they relate to each other. Lake ecology information is provided from physical, chemical, and biological perspectives. This important resource offers illustrations and links to other sites that help students grasp the science concepts that provide a basic understanding of lake ecology.

JUMP ONLINE!
Link to the WOW site via enc.org/focus/realworld

A complementary section describes the fundamentals of Geographic Information Systems (GIS), a computerized mapping technology that allows students to make relationships between activities that occur within a watershed (e.g., agricultural land use, commercial development) and water quality. The GIS resource section uses ESRI's Internet Map Server (IMS) technology to allow students to work interactively with maps through their Internet browser.

In a section called The RUSS, students are provided with an introduction to RUSS technology, WOW water quality measurements, reporting limits, and instrument accuracy. For students who are unfamiliar with water quality, a synopsis is presented for each RUSS measurement. The summary explains why the parameter is important, describes why there may be natural variations in the measurements of this parameter, and suggests how measurements of this parameter may be affected by human activities.

A glossary provides definitions of complex scientific terms. All glossary terms are linked to definitions throughout the web site. In addition, some terms are linked to pop-up explanations so students do not have to navigate to the glossary and then back to the text.

WOW Curriculum

WOW provides a growing collection of individual, yet integrated, lessons designed to enrich and enhance student learning in general science courses. The lessons are organized according to a sequence of six components—knowledge base, experimental design, data collection, data management and analysis, interpretation of results, and reporting results—that are critical to improving scientific and technological literacy. Using this format for scientific inquiry, teachers guide students through directed study or inquiry lessons depending on the students' abilities and the science curriculum.

Emailed notes and phone calls from teachers suggest that the WOW lessons and site are being used in a variety of ways. One teacher used a tutorial and lessons to help students learn and practice working with spreadsheets. Another teacher adapted a lesson on fish stocking to illustrate that organisms (fish populations) are limited by environmental factors. Three teachers used a lesson on data interpretation as a focus for students to carry out an inquiry project, resulting in scientific poster presentations. Other teachers choose ideas from the lessons and web site, then create their own lessons based on WOW data and resources.

WOW is Real

If you can't take your students to a lake every day, but you want them to do real science with real data, WOW may be the answer to your needs. Students enhance their knowledge of basic science concepts and their knowledge of the biological, chemical, and physical systems of lakes. They also develop and improve their skills in data analysis and interpretation, in using computer technologies, and in summarizing and presenting scientific information.

Through Water on the Web, science moves out of the classroom and becomes real. Students learn to apply reasoning skills to real-world issues as they work with the complexities of real scientific data. ●

Suggested Readings

Barrie, J.M. & Presti, D.E. (1996). The World Wide Web as an Instructional Tool. *Science* 274(5286), 371.

Franseth, S. & Poppe, B. (1996). Internet Activities Using Scientific Data (2nd ed.). Space Environmental Center Publication: ISBN-O-16-045541-3. Washington, DC: Department of Commerce/NOAA.

Lockard, J., Abrams, P.D., & Many, W.A. (1994). *Microcomputers for Twenty-first Century Educators* (3rd ed.). New York: HarperCollins.

Peterson, A. (1996). Research, Education, and America's Future. *Science* 274(5285), 159.

Riley, R.W. (1995-96, Winter). Connecting Classrooms, Computers, and Communities. *Issues in Science and Technology*, 49-52.

Rohwedder, W.J. and Alm, A. (1994). *Using Computers in Environmental Education: Interactive Multimedia and Online Learning*. Ann Arbor, MI: University of Michigan School of Natural Resources.

Wolf, K. (1996). Real-time Monitoring Makes Progress on Web. *US Water News* 13(5): 16.

Bruce H. Munson is a teacher educator at the University of Minnesota-Duluth. A former secondary science teacher, he has worked with curriculum development and teacher enhancement programs for the past 20 years.

George E. Host, a computer modeler and data visualization expert, and Richard P. Axler, a research limnologist, are research scientists at the Natural Resources Research Institute at the University of Minnesota-Duluth.

Cynthia A. Hagley has a research background in aquatic ecology and now works as an environmental educator for the MN Sea Grant Program at the University of Minnesota.

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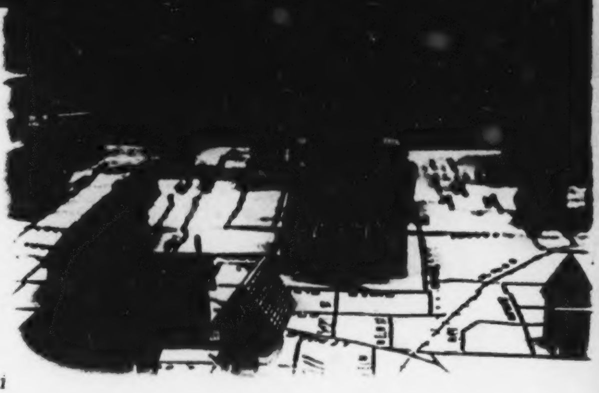


ARCHITECTURE:
An Across-the-Curriculum Project Connects to the Community

Elementary students look at their community with more awareness when they focus on the "built environment."

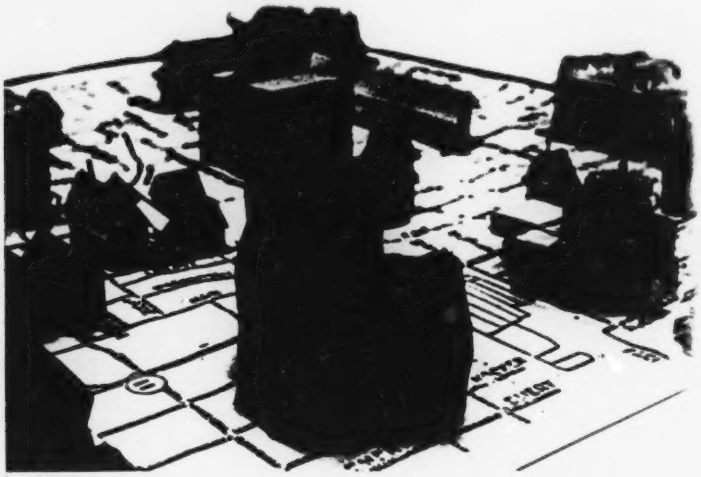
by Liesa Schroeder, Art Specialist, Independence, Missouri

Our students are constantly bombarded by visual stimuli such as fast-paced images on television, computers, CDs, and video games. As an art educator, I try to find innovative ways to help students develop skills in sorting, analyzing, and communicating the meaning of these images. I am also interested in current research suggesting that, next to working cooperatively, visual presentation skills will be most needed in the workplace of the future (Association for Supervision and Curriculum Development, 1998).

A recent project in our school district addressed many of these concerns while allowing me to find ways to connect the fine arts to all areas of the school curriculum.

Making Use of the Built Environment

The project my colleagues and I developed focuses on the local "built environment," the buildings, streets, and other constructions that students experience daily. Our first step was tapping in to teacher resource information from a national organization known as CUBE—The Center for Understanding the Built Environment (www.cubekc.org). This not-for-profit teacher resource center provides information on staff development, a web site of resources, teaching strategies, and curriculum consultation services.



Liesa Schroeder teaches art at Santa Fe Trail Elementary School in Independence, Missouri. The project described in this article was honored by the SuccessLinks Program of the Missouri Department of Elementary and Secondary Education as one of the "Best Teaching Practices" in the state in 2000. For more information contact: lschroeder@indep.k12.mo.us

Art and regular classroom teachers in grades three through six began with CUBE resources and then teamed up with local professionals including architects, engineers, city planners, and preservationists. The group decided that the interdisciplinary unit would be piloted at one elementary building in the school district and would involve 16 teachers and approximately 275 students. We hoped that the program would enable students to:

- Become actively engaged in their own learning by exploring, visualizing, and researching aspects of their own neighborhoods and communities.
- Become detectives as they worked to investigate and document architectural sites, situations, elements, and details through various techniques including digital photography.
- Apply their knowledge across the curriculum to include mathematics, science, reading, language arts, social studies, art, and electronic communication.
- Communicate their personalized discoveries through classroom assignments and student-generated photojournals preserved on CD-ROM.

As part of our planning, we devised measurable goals and outcomes aligned to art and core curriculum objectives. We also developed forms of assessment such as rubrics, scoring guides, surveys, and checklists to be used to monitor staff and student progress.

Planning for Success

Finding sources of funding outside of the school district was one of the keys to our success. The funding was used for staff development and technical training for staff and students, a resource library of architecture-related materials, digital cameras, software, imaging equipment, transportation to selected sites, and a professional photographer to photograph local sites. (The slides were professionally made so that we would have high-quality slide sets for instructional use district wide.)

The team of classroom teachers regularly met during the project and participated in sessions on the topic of built environment education. Other sessions helped the group develop technical skills in digital photography and in the use of imaging equipment.

Staff collaboration with architects and other professionals added authenticity. The experts helped teachers select local sites that matched core curriculum objectives and develop innovative teaching strategies. They also reviewed materials for a resource library and planned site-based visits.

Involving Students

The project began in art class, where the professional slide sets were used to build student knowledge of local architectural sites. Slides were examined carefully to familiarize students with various architectural elements, styles, details, and vocabulary. To reinforce this knowledge, students made perspective drawings, painted cityscapes, and constructed 3-D models.

At the same time, classroom teachers engaged students in activities that integrated architecture across the curriculum. Assignments included written reports, charts, graphs, schematic drawings, maps, timelines, and 3-D scaled models of houses, buildings, and the school neighborhood.

This work prepared students for classroom visits by the architects, engineers, city planners, and preservationists who were collaborating on the project. The experts shared information on job skills and career opportunities. They also interacted with students, explaining the many issues and challenges that impact our buildings and cities.

Out into the Real World

The classroom work was put into context as staff and students piloted walking tours to the selected architectural sites. Teachers created walking tour guidebooks for students to use on the site visits. The guidebooks targeted specific core curriculum objectives as well as problem-solving situations.

During the field trips, students worked in cooperative learning groups and used tools such as navigational compasses, magnets, rulers, and tape measures to gather, record, and organize information at each site. Students applied strategies in measurement and estimation as they calculated the length, height, area, perimeter, and the angles of structures.

Digital cameras were used to record elements of design. Students learned to zoom-in to record architectural details and building materials, as well as patterns, light and shade, and structural relationships. They considered ways to document time, continuity, and change by focusing on growth, erosion, and deterioration. They experimented with different angles and different points of view such as worm's-eye view and bird's-eye view.

The images were stored on disks, and students participated in photo-critique sessions upon returning to school. These sessions enabled students to sort, analyze, edit, organize, and select the best images. Written information was then added to these digital images, and the best images were then burned onto CDs by use of a CD-Recordable drive.

The resulting photojournals enabled students to create their own personalized record of their discovery of their own community and neighborhoods. The group as a whole was able to retrieve a vast collection of stored images and information.

As a follow-up, students shared their information through formal and informal discussions, multimedia presentations, Internet publishing, and other culminating activities.

Lasting Benefits

Both our staff and students benefited from participating in this innovative approach to curriculum construction and community-based education. Students were the real winners as they discovered their own city and neighborhoods. In addition, this program built new connections between students, staff, parents, administration, and community members.

By using the community as a visual textbook, this program not only served to reinforce art and core curriculum objectives, but also engaged students in a variety of learning styles that gave all students the opportunity to be successful participants. Students eagerly embraced the opportunity to work as mathematicians, scientists, historians, photographers, detectives, reporters, and artists. By presenting their discoveries and ideas, students were able to apply skills needed in the future workplace and develop a broader sense of the real world waiting beyond the classroom.

Reference

Association for Supervision and Curriculum Development, (Spring, 1998). *Arts Education: Curriculum Update*, p. 1.

AQUAPONICS ENCOURAGES FOURTH GRADERS TO EAT THEIR VEGETABLES

These elementary students eat the results of their science lessons. You can't get much more real world than that!

by Crystal McGee, Fourth Grade Teacher, Shrewsbury, Pennsylvania

Aquaponics involves growing plants hydroponically in combination with raising fish in an aquarium. The fish survive by eating a small amount of the plants, and waste products from the fish provide nutrients for the plants, making it a closed system.

Through a grant, our elementary school's greenhouse was able to purchase an aquaponic system. The fish tank water is pumped through piping into the plant beds. From there, the water is filtered through rock wool slabs and returned to the fish tank.

My fourth grade class became involved with the system at the beginning of the school year. They began by planting vegetable seeds in rock wool starter cubes. When the plants were two inches high, the children transplanted them into the plant bed or onto larger rock wool cubes, which were placed onto the slabs.

The tomatoes and cucumber plants grew at a fast rate and soon required netting and support. Our crops of basil, Boston lettuce, and watercress were quickly sufficient to feed the fish, and the children were eager to wash and eat the leaves themselves. It was exciting to see children appreciating the flavors of vegetables and herbs. We also grew Christmas cacti in the aquaponic beds, and they were blooming more than a month before Christmas.

Agribusiness and Other Life Lessons

One of our goals was to market our crops. This required the children to check grocery store prices of organic produce and consider our cost factors for each type of plant. The children set a price, including a profit, and offered our produce to school parents.

With their new pride in growing the plants themselves, my class looked forward to making a big salad as a reward for their efforts. Profits from the produce sale would be used to buy more seeds, rock wool cubes, and other supplies.

Children love feeding the Tilapia fish in our system because they are such noisy, enthusiastic eaters. Part of the plan was to sell the fish at the end of the school year.

This activity is exciting because it incorporates so many life skills. Family and consumer science, marketing and business education, and agriculture are all being explored. Integrated skills include reading information on fish and hydroponic plants, learning about the process of hydroponics, caring for fish, planting and caring for plants, measuring the growth of plants, computing cost and profit, and making a salad.

The students have learned that more and more of our food is grown hydroponically as our population increases and available farmland decreases. On the space station, hydroponically grown food will be a staple for the astronauts. This learning can certainly be applied when students become adults who may choose to grow their own food or care for fish.

I very much enjoy watching the children marvel at how the root systems grow in water and how quickly the plants grow. As an added bonus, more children are willing to eat their vegetables. The aquaponic system is so well designed and constructed that students in our school will enjoy and learn from it for years.

For more information about using aquaponics in the classroom,
contact:Scott Jones
Hydro/Aquatic Technologies
PO Box 777
Princess Anne, MD 21853
(410) 957-2680
Fax: (410) 957-2859
Email: aqua@hatech.com

Crystal McGee, a veteran teacher with 25 years experience, teaches fourth grade at Shrewsbury Elementary School in Shrewsbury, Pennsylvania. She would like to thank the organizations responsible for her grant, York County Alliance for Learning, which works with companies like Penn State York and the York Federal Bank to offer innovative technological grants each June to teachers in public and private schools.

USING TECHNOLOGY AND REAL-WORLD
TO TEACH SECONDARY MATHEMATICS CONCEPTS

Some specific advice on how to use technology
to make math relevant to students.

Visit enc.org/focus/realworld to link to all the web sites mentioned in this article.

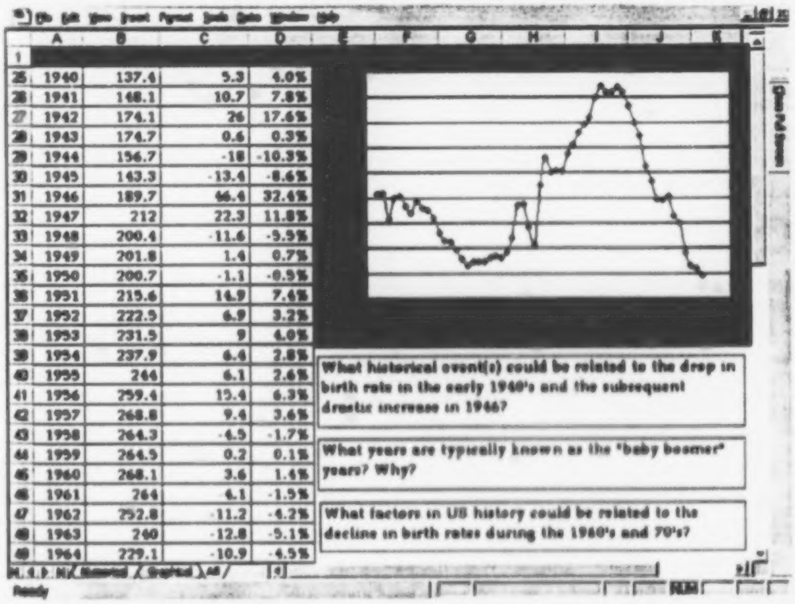
*by Hollylynne Stohl Drier, University of Virginia,
Kara M. Dawson, University of Florida, and
Joe Garofalo, University of Virginia*

The National Council of Teachers of Mathematics (NCTM, 1989) advocates that problem solving, reasoning, communication, and connections be woven throughout K-12 mathematics instruction. However, real-world connections are often missing from mathematics teaching. Technology facilitates applications of school mathematics to real-world situations by providing access to worthwhile data and tools that alleviate the computational constraints often involved in the analysis of real-world "messy" data. In this article we illustrate a few activities that help students develop conceptual understanding through the use of real-world data and electronic simulations of real-world events.

USING REAL DATA TO TEACH MATHEMATICAL CONCEPTS

Technology makes a vast amount of information readily available to students and teachers. Data found on the Internet can be quickly transported to a spreadsheet, and subsequently downloaded to a graphing calculator. Simplifying data gathering allows more time for emphasis on data analysis, interpretation, and conceptual development.

For example, students can use the Internet to gather information from the National Center for Health Statistics (www.cdc.gov/nchswww) on the number of live births in the United States, numerically and graphically analyze the data in a spreadsheet, and connect their analysis to events in US history. Figure 1 shows a spreadsheet containing birthrate data, the absolute and relative yearly increases and decreases, a graph of the data, as well as interdisciplinary questions related to US history. This data can help students understand "percent increase" and "percent decrease" by giving the numerators and denominators contextual meaning and connecting the calculations with historical interpretations of the data. In addition, algebra students can use the absolute differences from 1951 through 1955 to find a local slope for these data points. The typical definition for slope as "change in y over change in x" now has contextual meaning as "birthrates increase approximately seven per 1000 women in each year."



	A	B	C	D
25	1940	137.4	5.3	4.0%
26	1941	148.1	10.7	7.8%
27	1942	174.1	26	17.6%
28	1943	174.7	0.6	0.3%
29	1944	156.7	-18	-10.3%
30	1945	143.3	-13.4	-8.6%
31	1946	189.7	46.4	32.4%
32	1947	212	22.3	11.8%
33	1948	200.4	-11.6	-5.5%
34	1949	201.8	1.4	0.7%
35	1950	200.7	-1.1	-0.5%
36	1951	215.6	14.9	7.4%
37	1952	222.5	6.9	3.2%
38	1953	231.5	9	4.0%
39	1954	237.9	6.4	2.8%
40	1955	244	6.1	2.6%
41	1956	259.4	15.4	6.3%
42	1957	268.8	9.4	3.6%
43	1958	264.3	-4.5	-1.7%
44	1959	264.5	0.2	0.1%
45	1960	268.1	3.6	1.4%
46	1961	264	-4.1	-1.5%
47	1962	252.8	-11.2	-4.2%
48	1963	240	-12.8	-5.1%
49	1964	229.1	-10.9	-4.5%

What historical event(s) could be related to the drop in birth rate in the early 1940's and the subsequent drastic increase in 1946?

What years are typically known as the "baby boomer" years? Why?

What factors in US history could be related to the decline in birth rates during the 1960's and 70's?

Figure 1: Birthrate data from 1940 to 1964

Other current and archived data are readily available on the Internet at sites such as the National Oceanic and Atmospheric Administration (www.noaa.gov) and the National Geophysical Data Center (www.ngdc.noaa.gov). Much of the data at these two sites can facilitate understanding of mathematical concepts. Real-world phenomenon such as the tides, planetary orbits, and average monthly temperatures provide contextual situations for studying oscillating functions. Figure 2 shows temperature data for Washington DC, Verhoyansk, Russia, and Buenos Aires.

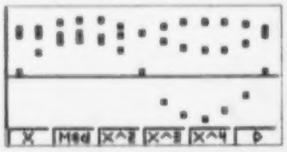


Figure 2: Average monthly temperatures for Washington, DC; Verhoyansk, Russia; and Buenos Aires

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Kara Dawson is an assistant professor of instructional technology at the University of Florida in the department of Instruction and Curriculum.

Joe Garofalo is an associate professor of mathematics education at the University of Virginia and co-director of the Curry Center for Technology and Teacher Education. Contact him via email: jg2e@virginia.edu

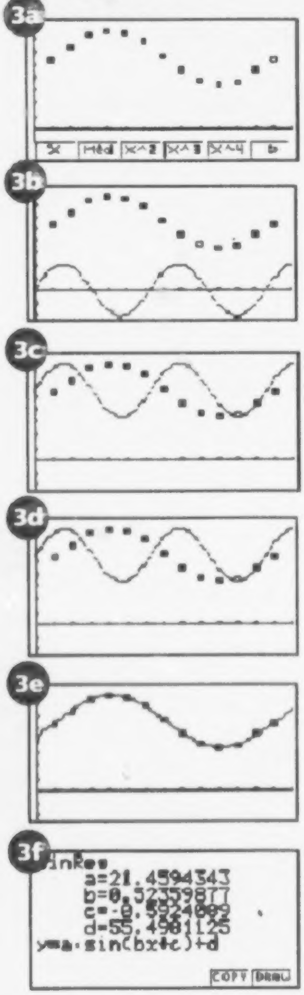


Figure 3: *Incremental curve fitting the Washington DC data*

```
SinReg
    a=21.4594343
    b=0.52359877
    c=-0.5924089
    d=55.4981125
y=a·sin(bx+c)+d
```

From the graph, students can see that the average monthly temperatures for all three cities oscillate with a period of one year. They should also notice that it is colder in Verhoyansk than in Washington, and that the temperatures in Washington and Buenos Aires are "out of phase."

Trigonometry students can incrementally fit a sine curve to each city's data by estimating the amplitude, vertical shift, period, and horizontal shift (Figure 3). Students and teachers can then relate the coefficients in the general form of the sine equation ($y = A\sin B(x+C)+D$) to the geographical locations of the cities. If this data is entered into a graphing calculator, students can also calculate a sine regression and compare the equation generated by the calculator (Figure 3f) with the one determined incrementally from the data and graphs.

USING SIMULATIONS TO DEVELOP CONCEPTUAL UNDERSTANDING

Another very powerful feature of technology is the ability to electronically simulate real-world events. Graphing calculators, spreadsheets, and the Internet offer students and teachers the capability to create and use simulations. Such simulations allow students to visualize and explore important mathematical concepts as well as real-world and interdisciplinary connections.

One such simulation on a graphing calculator can be used to explore exponential functions by applying them to investment strategies and the study of economics. Students can explore the effects of investing $1,000 over the next 20 years in money market, bond, or stock mutual funds. There are varying degrees of risk connected with each of these types of funds. To weigh risk versus return, students can estimate the average return for each of these investments over the next 20 years, assuming monthly compounding and growth rates of 5 percent, 8 percent, and 16 percent respectively.

Although this is an oversimplification of actual investment returns, it is instructive nevertheless. Students should notice that after 20 years the difference in accumulations is dramatic at $2,700 (money market), $4,926 (bond) and $24,019 (stock). By using the parametric mode in a graphing calculator, the exponential functions defining the growth of money are no longer static since parametric functions allow students to watch their money "grow" as the number of years increases.

Physical events can also be simulated through technology. For example, the study of parametric equations and trigonometry can be connected with the study of projectile motion in physics. The spreadsheet in Figure 4 was created in Microsoft Excel to dynamically simulate projectile motion. Using the sliders, students can manipulate the initial velocity, angle of projection, and height from the ground to observe the effects on the subsequent path of an object.

With the ability to manipulate time, students can animate the motion of the object and explore how long it takes for the object to reach its maximum altitude and when the object will hit the ground. By varying the other parameters, the students can explore how each affect the path of the object and connect these parameters with the coefficients in the sine and cosine equations.

Other investigations could include maximizing or minimizing altitude and horizontal distance. Manipulating different parameters and visualizing the path of the object can make the mathematical equations used to describe projectile motion more relevant and meaningful. In this way, creating and using such a simulation allows teachers and students to explore mathematical and physical concepts in an open-ended environment and use higher order thinking skills to analyze relationships.

TECHNOLOGY AS A MEANS

In the examples above, technology is not the focus of learning. Rather, it empowers teachers and students to explore mathematical concepts through the use of real-world data and simulations of real-world events. When technology is used in this way, interdisciplinary and real-world connections become a natural and powerful way for students to make sense of mathematics (Drier, Dawson, and Garofalo, 1999).

The Curry Center for Technology and Teacher Education at the University of Virginia is currently funded to develop materials to help preservice and inservice secondary mathematics teachers incorporate appropriate uses of technology into their teaching. The examples presented in this article are excerpts from materials that have been developed using the following guiding principles:

- Introduce technology in context of mathematical investigations;
- Address worthwhile mathematics with appropriate pedagogy;
- Take advantage of technology to go beyond what is capable with paper and pencil;
- Apply mathematics topics to real-world and interdisciplinary contexts;
- Incorporate multiple representations of mathematical concepts.

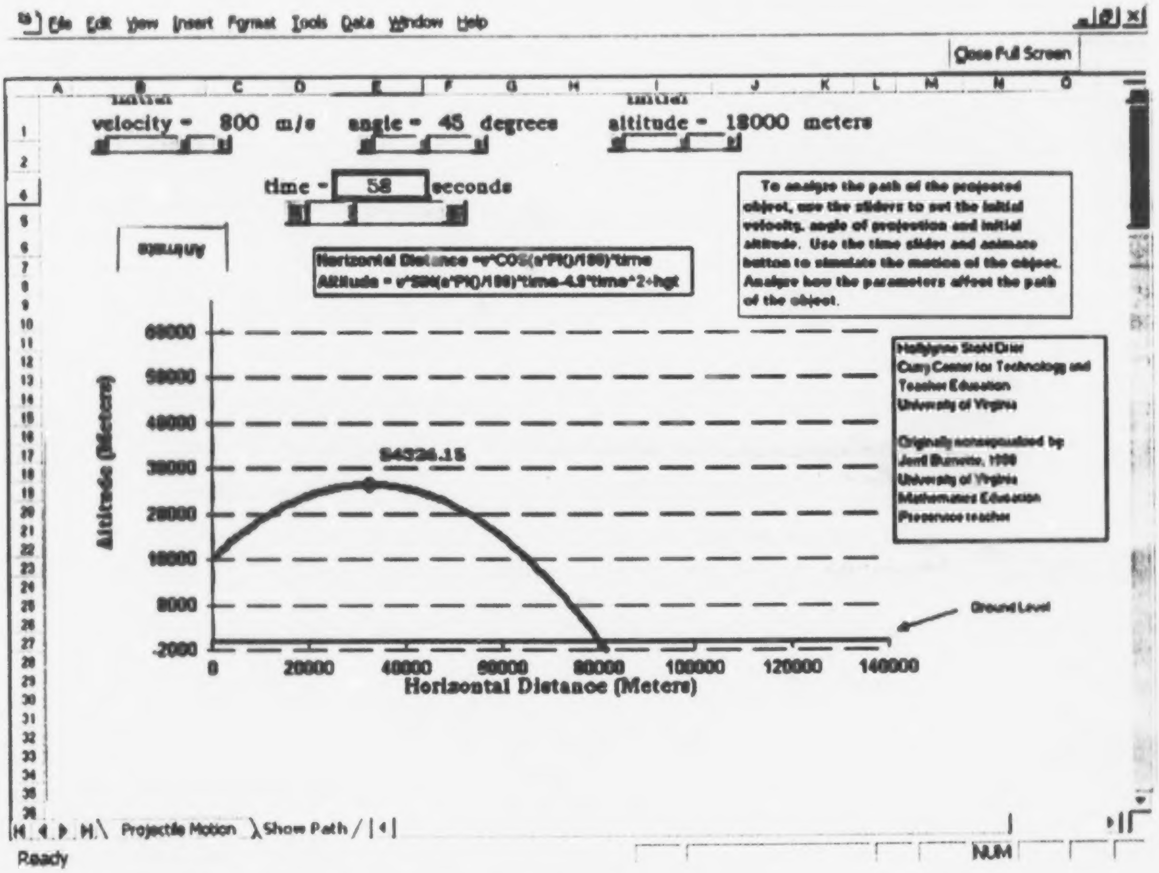
Activities available at the Center's Mathematics Education web page (curry.edschool.virginia.edu/teacherlink/math) use a variety of technology tools including spreadsheets, graphing calculators, The Geometer's Sketchpad, MicroWorlds, and a host of other mathematics software. We encourage you to visit our web site and test our activities in your classroom. We also want to know how these activities worked with your students and what modifications you may have made.

For more information about the Curry Center for Technology and Teacher Education, visit the Center's web site: curry.edschool.virginia.edu/teacherlink.

REFERENCES:

Drier, H. S., Dawson, K. M., & Garofalo, J. (1999). Not Your Typical Math Class. *Educational Leadership* 56 (5), 21-25.

National Council of Teachers of Mathematics (1989). *Curriculum and Evaluation Standards for School Mathematics.* Reston, VA: author.



initial velocity = 800 m/s angle = 45 degrees initial altitude = 18000 meters

time = 58 seconds

Horizontal Distance =v*COS(a*PI()/180)*time
Altitude = v*SIN(a*PI()/180)*time-4.9*time^2+hgt

To analyze the path of the projected object, use the sliders to set the initial velocity, angle of projection and initial altitude. Use the time slider and animate button to simulate the motion of the object. Analyze how the parameters affect the path of the object.

Hollylynne Stohl Drier
Curry Center for Technology and Teacher Education
University of Virginia

Originally conceptualized by
Jerri Burnette, 1998
University of Virginia
Mathematics Education
Preservice teacher

Figure 4: *Excel spreadsheet created to analyze projectile motion. Available from http://curry.edschool.virginia.edu/teacherlink/math/interactiveexcel.html*

DESIGN CHALLENGES PROPEL EARTHLY PROBLEMS INTO ORBIT

Standards-based activities bring the excitement of space exploration into the classroom and can be adapted for students from elementary school through senior high.

By Anne Ireland, Challenger Center for Space Science Education, Alexandria, Virginia

Living and working in space has become a reality. American astronauts regularly orbit Earth on Space Shuttle missions, Americans and Russians have lived aboard the Mir Space Station, and soon astronauts from several countries will be living and working aboard the International Space Station for months at a time.

It's a high-tech orbiting home and workplace—but it has all the possibilities of problems that exist here on Earth.

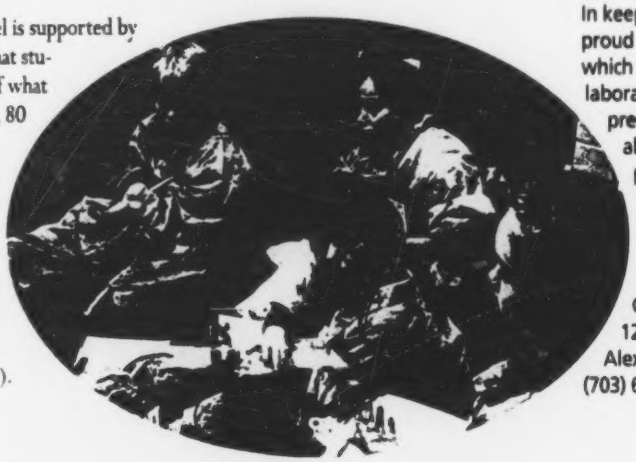
As part of the annual Space Day initiative, Challenger Center for Space Science Education—in conjunction with more than 60 prestigious partners in education, science and industry—created a series of Design Challenges that combine real-world problems with the excitement of the challenges of living and working in space. Although the Challenges are created for students in grades four through six, teachers can adapt the activities for a variety of grade levels. Three Design Challenges from Space Day 2000 are reproduced here.

The Method Behind the Mission

Some of the best learning occurs when students work together for a common goal, just as the men and women of NASA do. Each Design Challenge uses the Expert-Jigsaw model, through which students first research their specific portion of the team task, then teach the other members of their team what they've learned. Each student's contribution is unique. Each student expert's efforts are required and indispensable for group success.

By sharing their expertise, students promote each other's learning. Each student expert is accountable for a share of work but is also concerned with assessing who may need more assistance, support, and encouragement.

The Expert-Jigsaw model is supported by research, which shows that students learn 95 percent of what they teach someone else, 80 percent of what they experience personally, and 70 percent of what they discuss with others. In contrast, students learn only 10 percent of what they read and 20 percent of what they hear. (Glasser, 1998).



CHALLENGER CENTER FOR SPACE SCIENCE EDUCATION

Challenger Center for Space Science Education is a global not-for-profit education organization created in 1986 by the families of the astronauts tragically lost during the Challenger space shuttle disaster. Dedicated to the educational spirit of that mission, Challenger Center develops Learning Centers and other educational programs worldwide to continue the mission to engage students in science and mathematics education.

Challenger Center's network of Learning Centers throughout the Unites States, Canada, and the United Kingdom has been a recognized leader in educational simulation, with a strong standards-based emphasis. Challenger Learning Centers and Challenger Center's award-winning classroom and teacher training programs all use the fascination of space exploration to create positive learning experiences that:

- Raise students' expectations of success;
- Foster in them a long-term interest in math, science, and technology;
- Help them develop critical communication, decision-making, team-building, and collaborative skills.

In keeping with these goals, Challenger Center is a proud partner of Space Day, held in May each year, in which students and scientists all over the world collaborate to solve Design Challenges like the ones presented on pages 42-43. For more information about Space Day and other Challenger Center programs, visit the Challenger Center web site: www.challenger.org

Or contact:

Challenger Center for Space Science Education
1250 North Pitt Street
Alexandria, VA 22314
(703) 683-9740 / Fax: (703) 683-7546

Anne Ireland is the Director for Educational Materials Development at the Challenger Center for Space Science Education. Email: aireland@challenger.org

Another benefit to students is that through the Design Challenges' investigative, problem solving approach, each level of Bloom's Taxonomy (knowledge, comprehension, application, analysis, synthesis, and evaluation) is being touched upon.

Up to the Challenge, Up to the Standards

In using the Design Challenges, teachers are promoting the overarching National Science Standards (National Research Council, 1996, p.52) that their teaching should:

- Focus on student understanding and use of scientific knowledge, ideas, and inquiry processes;
- Provide opportunities for scientific discussion and debate among students;
- Share responsibility for learning with students; and
- Support a classroom community with cooperation, shared responsibility, and respect.

More specifically, the Challenges emphasize the following National Standards:

- ***Technological Design***
  All students should be able to identify appropriate problems for technological design, and design a solution or product (p. 135).

- ***Science as Inquiry***
  All students should be able to use appropriate tools and techniques to gather, analyze, and interpret data (p. 145).

- ***Science as a Human Endeavor***
  All students should recognize that important contributions to the advancement of science, mathematics, and technology have been made by different kinds of people, in different cultures, at different times (p. 141).

Ongoing Support

We at Challenger Center for Space Science Education invite you to contact us for help in making your school's science program the very best it can be. Among our many commitments to continuing the mission of Challenger, we believe that in every young mind there is a window to the universe, and when that window is opened, students develop strengths—including skills in leadership, decision-making, trust-building, communication, and conflict management, as well as scientific research and problem-solving skills—that will help them cope with the real world that surrounds them every day.

References

Bloom, B.S. & Krathwohl, D.R. (1986). *Taxonomy of Educational Objectives. Handbook I: Cognitive Domain.* Menlo Park, CA: Addison-Wesley.

Glasser, W. (1998). *Quality Schools.* New York: Harperperennial Library.

National Research Council (1996). *National Science Education Standards.* Washington DC: National Academy Press.

DESIGN CHALLENGE #1: COMMUNICATION

Space Walk Talk

Planet Earth Connection

Consider some of the communication challenges in your community or home: The telephone stops working…you get laryngitis…your computer goes down…you meet someone new who cannot speak or hear.

International Space Station (ISS) Situation

The communication (COM) units on the spacesuits used for extravehicular activities (spacewalks) have malfunctioned. Over the course of two months, every one of the units has failed. All oral communication outside the Space Station has been lost. It will be another month before replacements arrive, but work outside of the ISS must continue.

Urgent Action Required

Communication is essential to your mission! Without it, the mission will fail. Your team has been tasked to develop a nonverbal way for the astronauts on extravehicular activities (EVAs) to communicate with the crew inside the ISS over a distance of at least 5 meters. Remember, the spacesuit is bulky and movement is limited. Any equipment required must support nonverbal communication.

Student Expert Groups

- Animal Behaviorist: Studies the communication methods of various animals.
- Nonverbal Communication Specialist: Studies methods people use, other than speaking, that allow them to communicate.
- Space Communication Specialist: Learns about the different systems that are used for communicating in space and the limitations of communications in space.
- Communications Technologist: Studies the different types of communications equipment that are being developed and used.

Anticipated Outcomes

The Design Solution will most likely result in a paper-based plan with drawings/illustrations or perhaps pictures.

Thinking Beyond

The student team will also be asked to apply what they learned to communicate with someone who speaks a different language and does not understand English and with someone who is hearing impaired.

DESIGN CHALLENGE #2: WATER PURITY

Water ReCycle

Planet Earth Connection

Consider the water purity challenges on our planet: Water quality is an increasingly serious problem all over the globe. Pollution from industrial and residential waste, fertilizers, automobiles, and many other sources include bacteria that can threaten lives, even in technologically advanced societies. When natural disasters strike—floods, hurricanes, earthquakes—the shortage of drinkable water is one of the most life-threatening problems.

International Space Station (ISS) Situation

With the high cost of carrying water into orbit to replenish supplies aboard the International Space Station, as much water as possible needs to be recycled. Water is critical to human survival. During a routine test of water quality on board the Station, it is discovered that unknown contaminates have polluted the water supply! Without clean water the mission is in jeopardy, and the crew will have to return home within 15 days when the current supply runs out.

Urgent Action Required

Several task forces have been assembled to develop a means of purifying the water supply and saving the mission. The device must be able to purify at least 500 milliliters at a time.

Student Expert Groups

- Water Quality Specialist: Investigates acceptable water standards for human consumption.
- Hydrologist: Learns about the different sources and properties of water.
- Water Purification Systems Specialist: Investigates materials and systems used in the process of purifying water.
- Water Reclamation and Recycling Specialist: Learns how water can be collected and reused on a space station.

Anticipated Outcomes

The Design Solution will most likely result in three-dimensional working models, as well as a materials and procedures list. Encourage students to also produce graphs tracking the results of their tests.

Thinking Beyond

The student team will also be asked to apply what they learned to purifying water (or snow) when faced with a natural disaster like a flood, hurricane, or earthquake.

DESIGN CHALLENGE #3: EXERCISE

X-treme Fitness

Planet Earth Connection

Consider exercise challenges here on Earth...Exercise is crucial to human health. Whether we swim, walk, or climb stairs, our muscles, bones and cardiovascular system need to be kept in shape.

International Space Station (ISS) Situation

Medical reports of crewmembers on board the ISS reveal that they are experiencing bone and muscle tissue deterioration due to inadequate exercise. While their exercise equipment is adequate and well-tested, doctors claim the crew's state of poor fitness is due to infrequent exercise.

Asked about this, crewmembers admit to being bored with the same old routine and equipment. The ISS crew has challenged the physical therapists to come up with more entertaining equipment and interesting ways to exercise in microgravity.

Urgent Action Required

Your team has been challenged by the ISS crew to create an entertaining sport, game, or exercise equipment for the space crew to help them keep bone mass and muscle tone. Any equipment designed must be compact and lightweight and include instruction manuals. Sports and games should include instructions and rules.

Student Expert Groups

- Microgravity Specialist: Learns how objects and people are affected by a weightless environment.
- Physical Fitness Specialist: Investigates different types of exercise equipment and sports/games.
- Exercise Physiologist: Explores how the human body (muscles, bones, heart, etc.) works when exercising or playing a sport/game.
- Crew Fitness Trainer: Learns about fitness equipment and exercises that are currently used by astronauts in a weightless environment.

Anticipated Outcomes

The Design Solution will most likely result in a paper-based product and possibly photos, but don't rule out some interesting models of exercise equipment.

Thinking Beyond

The student team will also be asked to apply what they learned to make their recess time more entertaining and their sport/games more beneficial to their bodies.

MATH FROM THE TOY STORE

Use of scaled replicas makes learning about ratio and proportion fun in this teacher's middle school math classes.

by Robin Cohen, Middle School Mathematics Teacher, Eastchester, New York

For a number of years I have used model trains, cars, dollhouse furniture, figurines, and any other scaled replicas I could find to teach ratio and proportion. Students begin by measuring real cars and furniture. They especially enjoy going outside to the parking lot to measure various aspects of cars—length, width, tire diameter, and so forth. We also measure furniture at school and at home.

Understanding of ratio and proportion begins when students measure models and scale them to the real life objects. Dollhouse furniture is scaled one inch to one foot. The simplicity of this scale makes the furniture ideal for a first look at scale replications. Students are given the opportunity to work with ratio without worrying about conversions.

Model cars are available in many different scales. I have used scales ranging from 1:144 to 1:18. At times I have been fortunate to acquire the same type of car in two different scales. The students measure various parts of the cars and then compare them. We also discuss trends in car sizes over the years.

Photo by Roberta Pheifer

Model trains come in standard sizes including O (1:48), HO (1:87), N (1:160), and Z (1:220). All the railway cars and accessories are available in each scale, and collectors generally work with only one scale. One year, we were able to take a field trip to visit a store devoted to model trains, and the students got the chance to see first hand all the different scales and to talk to an avid collector.

One popular activity involved NASCAR racing, which interests a number of my students. Kellogg is among a number of major corporations that sponsor cars. One year, the company put portraits of drivers and their cars on boxes of cereal and offered a scaled replica of a racing helmet worn by one of the drivers. The ratio of the model helmet to the actual one was 1:4. In addition to allowing students to work with another ratio, the helmet's shape provided a varied look at scale replicas. After we did ratio problems, the students each had a bowl of cereal from the NASCAR-decorated boxes.

An extension of this unit is building model cars. Although I was not familiar with the process, the students were excited about the hands-on project. Model building is time consuming so we worked on the models over a period of a few weeks. The students worked on their models every other day, continuing their work while we finished the unit on ratio, proportion, and percent and began our next unit.

The model-building project led to one of my best moments in teaching. The model cars we built were scaled 1:25. As a quick assessment of students' understanding, I asked each student individually to tell me what the scale meant. One student told me that it meant a real car would be four times as large. I asked him if he could get into a car that was four times as large as the model he was holding. He looked at me with complete amazement and told me absolutely not. Thinking hard, he replied that a real car would be 25 times as large. By George, he got it!

I think anyone can experience success using replicas to teach ratio and proportion. It is fun, it appeals to students, and it is adaptable to many different situations. You can use whatever is at hand and have a good time with real-world mathematics.

MEETING THE STANDARDS

The activity described in this article supports the Learning Standards for New York State in Mathematics, Science, and Technology (MST), specifically:

Number 3: Understand mathematics and become mathematically confident by communicating and reasoning mathematically, by applying mathematics in real-world setting, and by solving problems through the integrated study of number systems, geometry, algebra, data analysis, probability, and trigonometry.

Number 7: Apply the knowledge and thinking skills of mathematics, science, and technology to address real-life problems and make informed decisions.

Robin Cohen is the department chair for mathematics at Eastchester Middle School in Eastchester, New York. She has previously won grants for units that are practical, hands on, and high interest.

Link to all available state frameworks via ENC Online, enc.org

HUNTING FOR ASTEROIDS, COMETS, AND NOVAE

Empower your students with the tools and techniques that could make them famous and maybe save humankind from extinction!

by Dennis Erickson, Science Teacher, Chicago, Illinois

You have heard of Comet Hale-Bopp and the meteor that may have killed the dinosaurs. Well, thanks to the Internet, digital cameras, and image processing software, just about anyone has a chance of discovering the next comet or an asteroid headed toward our planet Earth—hopefully in time for us to try to send a rocket to deflect the killer rock. And all this without a telescope!

Thanks to my alma mater, the University of Illinois in Urbana, nightly pictures of the sky are available to anyone with an Internet connection. The astronomy department has a camera lens attached to a sensitive CCD chip that takes fantastic shots of the stars. The pictures are automatically uploaded to their Internet site called Stardial. One image is taken every 15 minutes in a strip just below the celestial equator. Images from the past three years are available at the site.

Using Stardial in the Classroom

I captured students' attention by discussing the dinosaur extinction and by showing several videos about asteroid impacts and dangers. Then I had each student in my astronomy class choose an area of the sky that Stardial imaged. Steps for using Stardial are detailed starting on page 44.

Students checked their area each clear night and compared the new images with older ones to find any differences.

Over the course of weeks, several objects were found. Most turned out to be airplanes or satellites. Two unknown objects were found and tracked for several days. Our project and two students were featured at the Tech 2000 exhibit at the state capitol, on a Chicago talk radio show, and on the evening news of a Chicago television station.

The objects were compared to an asteroid database and were later found to be known asteroids. We will keep looking!

Dennis Erickson (derickson@latinschool.org) teaches astronomy, electronics, and computer literacy in grades 6-12 at The Latin School of Chicago. A life-long amateur astronomer and ham radio operator, his current project is sharing the wonders of the night sky and educating the public about light pollution and its solutions.

Benefits of the Project

This project builds many skills in astronomy. Students learn to use the coordinate system of the sky (right ascension and declination) and the brightness scale of the stars (magnitude). The size of the images and speed of the motion of the objects are measured. Retrograde motion is shown on some of the images. Students also get the opportunity to explore the creation of digital images of the night sky with CCD cameras.

The project also builds computer skills. Students practice visiting Internet sites by typing in the web addresses. They learn to download images and convert them from one format to another. Other skills include saving and opening files and digital image processing, animation and aligning, measuring, and enhancing the images.

Perhaps the most important benefit is that the work of a scientist is highlighted. Students learn patience—many thousand images may need to be checked before a discovery is made. Surprise! The work can be boring! Students learn to face disappointment when they think they have a discovery and it turns out to be a known object, not a new one. They come to appreciate the persistence needed by scientists. Students see that there may be no immediate results, and a project may take years to complete.

At the same time, they begin to imagine the thrill of discovery and being the first person to see a new object. They enjoy collaborating with other scientists. They begin to realize that sometimes important discoveries are made by accident.

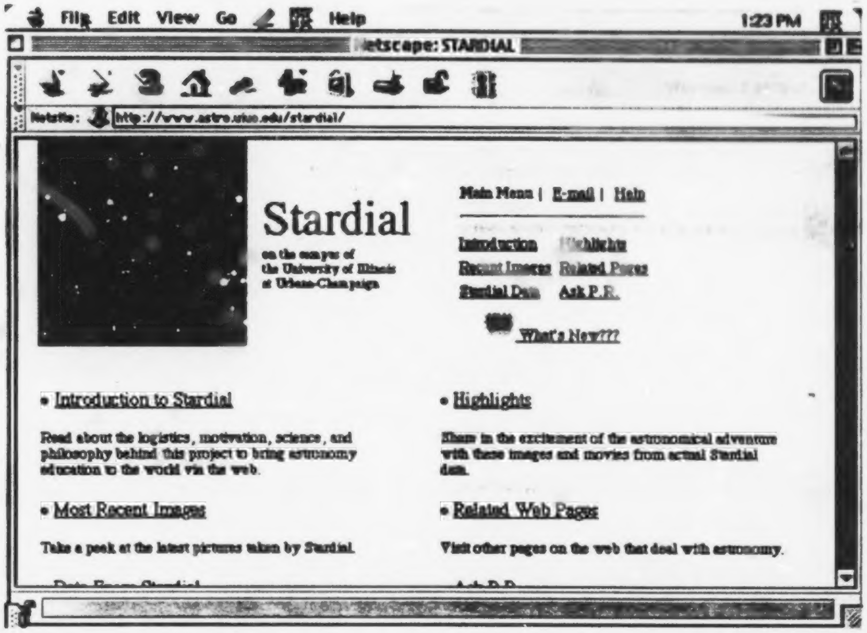
Steps for Using Stardial

Here are the steps, using a Macintosh. (Windows is similar, but not identical. Steps to use with that operating system are inserted as needed.) Please note that other software and hardware differences may affect the steps you need to use. Also be aware that web sites do change over time. **For help in making this Stardial activity work for you, email the author: derickson@latinschool.org**

1. Download the pictures.

Using the WWW browser Netscape, connect to the Stardial site (www.astro.uiuc.edu/stardial). Download two images from the same place in the sky that were taken on different days. Two images with the file names of 01060530 and 01070530 would be good to download and compare.

Note that the first four digits of the picture's file name tell you when it was taken (0106=January 6). The next four digits tell you the picture's location in the sky (0530=05 hours, 30 minutes RA). RA is similar to longitude, but it is on the celestial sphere, not on Earth.



Read about the logistics, motivation, science, and philosophy behind this project to bring astronomy education to the world via the web.

Share in the excitement of the astronomical adventure with these images and movies from actual Stardial data.

Take a peek at the latest pictures taken by Stardial.

Visit other pages on the web that deal with astronomy.

Stardial images are quite large in sky area—about 8 x 5 degrees, but only about 50K in file size. They do not take long to download in the JPEG format. If the image is all white (6K size), the sky was cloudy on that date. Try another image with a file size around 25K.

Here is the path to two images, taken on clear nights, that you can use for your first try:

- Start Netscape and go to the site: www.astro.uiuc.edu/stardial
- Click on Web (under Data), then jpg/, then RA/, then 0530/, then 2000/, then 0106.jpg.
- This will display an image of stars.
- Now save this image: File/Save As, choose Format Source (change Text to Source).
- Now do the same for the 0107.jpg image.
- *For Windows,* save images with the .bmp extension, choosing All Files in the pull-down menu.

2. Convert the pictures to a usable file format.

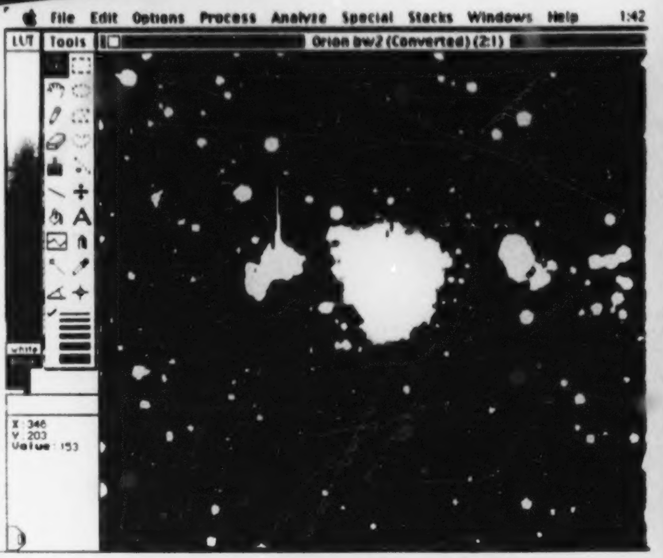
(If the JPEGs open in NIH Image, you can skip this step. A Quicktime converter on your Mac may allow them to open directly in NIH Image.)

For Macs, the images are in a JPEG format. The image processing software you will use does not open JPEG so the images must be converted to a PICT or TIFF format.

- Open the first image in JPEGView 3.3.
- Save As and choose the PICT format.
- Do the same for the second image.

Stardial has been, by far, the best resource I have ever used for motivating my astronomy students. Stardial images provide the chance to do real science and make a real discovery. Students know that perhaps their discovery could even save humankind from extinction (like the dinosaurs) by spotting a killer asteroid in time to send up rockets to push it off course. These are all real possibilities, and my students get very interested and excited about them.

With the real-time images of Stardial as motivation, my students are learning all about astronomy as well as computers, image processing, and the Internet.



- *For Windows,* use an image manipulation program (such as Paint) to open your .bmp files and Save As true bitmap images. Save in 256 colors.

3. Set memory requirements and open the images.

The National Institutes of Health has a freeware program called Image that you can download from rsb.info.nih.gov (then click on NIH Image/ImageJ, then Downloads, then nih-image162_fat.hqx). Or for Mac and PC, you can get the program from www.cipe.com (then click Software/Images, then NIH Image Software or Scion Image Software). The Scion site requires you to register before you download, which will not cause a problem for you. Use your school's address if you wish.

- Set the Memory Size of Image to 10000K. Do this by clicking once on the Image icon and then File/Get Info/Memory.
- Set the Preferred Size to 10000.
- Set the Image Buffer to 3000K. Do this by starting the program and then accessing Options/Preferences.
- Set the Undo and Clipboard Buffer to 3000.
- Quit the program.
- Start Image.
- Open the two PICT or bitmap images.

4. Make a stack from the two images.

You will put one image on top of the other in a single file called a stack.

- Menubar/Stacks/ Windows to Stack.

5. Align the images. (You can skip this step for your first try).

The two images may not be exactly stacked, so we need to register (align) them.

- Go to the Menubar/Stacks/Register and follow the directions that appear on the screen. (A fiducial point is a reference star that appears in both images.)
- After you do Stacks/Register and click Register, click ONCE on the exact center of a small star near the upper left corner of the image. REMEMBER WHICH STAR.
- Then click TWICE quickly on a small star in the lower right corner. REMEMBER WHICH STAR. (Do not move the mouse between the clicks, and they need to be two fast clicks.)
- The next image (slice) will appear. Do the same clicking on the same stars. This will align the two images.

6. Blink the two images.

Now that the images are aligned, we can blink them to check for differences. Show the two images, alternating between the two rapidly. Any object that is in one image, but not the other, will blink.

- Menubar/Stacks/Animate.
- Change the rate using the number keys on the keyboard, 1=slowest.

7. Check the identity of blinkers.

If you find a blinker, it could be a nova, asteroid, comet, satellite, or...??? Email the date, time, and location to another observer and ask that person to confirm your finding. My students and I can try to confirm findings with others who find objects. The software program called Starry Night (www.siennasoft.com) plots many known asteroids and can be used to identify asteroids you find. Or search for asteroids on the Internet to find ways of reporting your finds. It may be a known object or, if you are lucky, a brand-new find.

Another activity using Stardial is finding and plotting the light curve of variable stars. The AAVSO has a nice program called Hands-On Astrophysics (www.aavso.org). The Stardial site has more activities, and students can think of additional activities as well.

Focus on the Collection:

Resources to Help You Bring the Real World into Your Classroom

by Terese Herrera and Carol Damian, ENC Instructional Resources

Classroom work in mathematics and science should be meaningful to students in that it should have some connection to the world they live in. What kinds of activities and problems do our young people experience daily that have natural, but often underemphasized, connections to important mathematics and science principles? Here are just a few examples:

What makes some hits with a baseball bat better than others?
How much trash do we accumulate in our wastebaskets in a week?
Can we assume that we'll always have enough clean water?
Where does our food come from?
Can our family afford to take a vacation to Orlando?
Do we have enough land space on Earth to support the growing world population?

In this section of *ENC Focus,* we have attempted to identify some resources that will help you and your students make significant connections between classroom learning and matters of everyday life. The aim of each resource here is to build a bridge to the real world, involving students in the mathematics and science of everyday happenings. Yet each resource differs in how it builds that bridge.

- Some provide connections between different disciplines, such as art and math (e.g., The Mathematics of Architecture or Mathematical Quilts).
- Some resources uncover the science and math hidden in familiar events, such as science in toys (Exploring Energy with TOYS) or in sailing a boat (Sailing Through Bernoulli).
- Others deal with questions that young children bring to school and that still fascinate older students: What is lightning? (A Handful of Lightning) How do planes fly? (The TAKE OFF! Kit)
- Some are simulations that put students into a scenario in which they problem solve within a "real" context, such as designing a swimming pool (Pooling Around) or making a medical decision (A Problem of Life and Death). In these environments students work within a complex situation, in contrast to textbook problems that often focus on one skill at a time.

We present the resources in groupings that we hope will relate to your teaching needs and that range across all grade levels. In many cases, students are involved in activities in which they must make decisions, choose appropriate calculations, identify formulas, and create solutions within contexts that, even though imaginary, are analogous to situations in our everyday world.

Learning for real-world applications opens a need for deeper understanding of the issues involved and of the related math and science content. In Background Knowledge, we suggest resources that will help teachers as well as students reach this understanding.

A section on Professional Development provides ideas on teaching strategies and other issues related to guiding students through real-world exploration.

Finally, realizing that one of the most frustrating parts of preparing and implementing a lesson can be finding actual data, we have included a set of Internet sites as sources of Real Data.

As always, we must emphasize that this list of exemplary resources is not comprehensive. The materials featured in this issue were selected from the existing collection at ENC. Furthermore, due to limitations of space, we can present only a sample of the innovative materials available to you as you open your classroom to real world experiences.

Please note that this section is based on abstracts found in ENC's database of K-12 materials. All ENC abstracts are descriptions rather than evaluative reviews. You will find complete ENC records for these selections via the online version of *ENC Focus* (enc.org/focus/realworld). Some records provide links to online, third-party reviews and/or references to journal reviews. Pricing and ordering information was verified in April 2000, and is subject to change. ●

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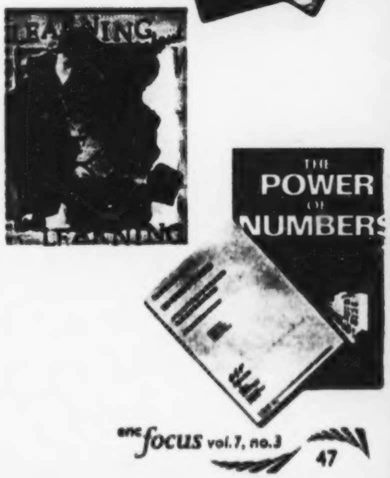

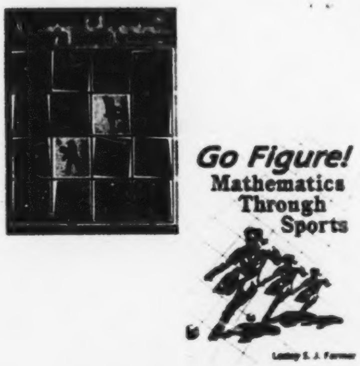

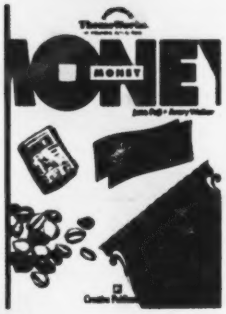

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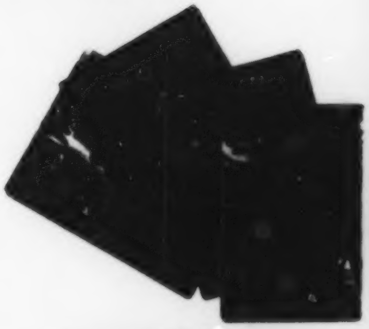

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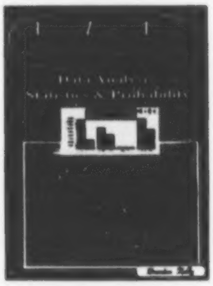

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Searching ENC

When you go online to learn more about the materials highlighted here and others, you will find more than one option for searching through ENC's vast collection. Here are a few general tips for making best use of ENC's database of teaching resources.

- The simplest search for curriculum resources on ENC Online allows you to type in any word, and select cost and grade level. Links at this search provide assistance in choosing words.
- The more advanced search options allow you to construct even more specific searches—this is great if you have very clear requirements in mind.
- The materials in this section were carefully selected by ENC's content specialists to fit the theme of this issue. If you would like to see more materials on this topic from ENC's collection, you can create your own search. Hint: To do our initial searches, we used terms such as
  "real world applications"
  "environment"
  "consumer mathematics"
  (Be sure to include quotation marks around search words.)
- The catalog records printed in this part of the magazine contain just the highlights of the full catalog record. To go directly to a specific record, type in the ENC number in the search window of any search option. It is important to type the ENC number exactly as is appears at the end of the item's abstract in this magazine.

Math and Science All Around

Math Around Us

KinderVentures series

Grade: K
1995
Author: Optical Data Corporation

Ordering Information
Optical Data School Media
512 Means St NW, Suite 100
Atlanta, GA 30318
(404) 221-4500 / Fax: (800) 953-8691
Toll-free: (800) 524-2481
www.opticaldata.com

$621.00 per kit
Note: Replacement components available. Call publisher for more information and for system requirements.

Standards: NCTM Curriculum and Evaluation Standards (1989)

This kit, part of the KinderVentures series, is a multisensory program that engages young learners in finding out about themselves and the world around them. The program is mathematics and science oriented and has connections to social studies, language arts, and the arts. It incorporates videodiscs, hands-on activities, read aloud stories, literature and manipulatives through the adventures of Pocket and Tails, twin Wanderoos (tm), that guide teachers and students through both familiar and new concepts. This unit, Math Around Us, contains five lessons that help children learn about shapes and patterns, counting and sorting, picture and bar graphs, units of measurement, and addition and subtraction. The teacher's guide provides detailed lesson plans, a bar code index to laserdisc images and movies, and individual and group activities. In addition to traditional assessments, the guide also indicates activities that would be appropriate for inclusion in portfolios or as alternative assessments. The guide also provides reproducible student worksheets, a bibliography of children's literature, and connections to other disciplines, subject areas, multicultural perspectives, careers, and basic skills. The accompanying CD-ROM provides narration, QuickTime (tm) videos, and matching games that improve hand eye coordination, memory skills, and understanding of math concepts. The kit also provides a large floor graphing mat and a booklet that presents suggestions for developing mathematical ideas using stories and poems from children's books. A Spanish version is also available. (Author/LCT) ENC-006490

A Handful of Lightning: Full Participation Science Experiments for Young Scientists

Grades K-6
1997
Author: Ernie Batson and Mary Batson

Ordering Information
Sunshine Consultants
417 Clover Lane
Fort Collins, CO 80521
(970) 495-9782 / Fax: (970) 495-6863
Email: EMSunCo@aol.com
www.iwant2learn.com

$15.95 per book (paperback)

Standards: Colorado Model Content Standards for Science (amended, November 1995); National Science Education Standards (December 1995).

This activity book is a compilation of 40 science experiments that require simple, everyday materials. In sample experiments, students use air pressure to push a straw into a potato, use hot and cold water to inflate a balloon, and make a rolling can reverse and return. Each experiment is written with step-by-step instructions and includes simple explanations, variations to extend the experiment, and real-life connections, as well as correlations to Colorado and *National Science Education Standards* (1995). (Author/LCT) ENC-014627

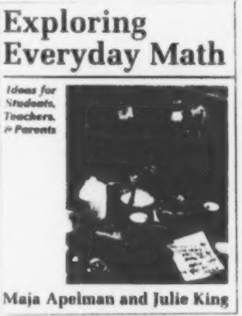
Exploring Everyday Math: Ideas for Students, Teachers, & Parents

Grades K-6
1993
Author: Maja Apelman and Julie King

Ordering Information
Greenwood Publishing / Heinemann
Educational Books Inc
88 Post Road West
PO Box 5007
Westport, CT 06881
(603) 431-7894 / Fax: (800) 203-1502
Toll-free:(800) 793-2154
Email: custserv@heinemann.com
www.greenwood.com

$25.00 per book

Standards: NCTM Curriculum and Evaluation Standards (1989)


Exploring Everyday Math
Ideas for Students, Teachers, & Parents
Maja Apelman and Julie King

This teacher's guide provides plans for math activities that center on the daily life of the family. The authors address two themes in the guide: the problem of the isolation of mathematics learning from life experience and the need for parent involvement in students' mathematics learning. Most of the activities begin in the classroom, where students are encouraged to use their imagination, share ideas, and ask questions on topics from their daily lives. The authors believe that students will respond enthusiastically to the activities and will be prepared to participate in the second phase, which takes place at home. Parents and other family members are asked to join in the process, contributing information, sharing their knowledge, and taking part in the investigations. With the completion of the home phase, the program is wrapped up in the classroom where students compile, organize, and interpret the ideas and information they gathered at home, presenting them through murals, graphs, written descriptions, books, or displays. In addition to the activity plans, the guide contains an extended discussion of how children learn mathematics. A curriculum chart shows how the activities can be used to address specific mathematical topics for different grade levels. Also provided are sample letters to parents and book lists related to specific topics. (Author/GMM) ENC-006935

Beyond Facts and Flashcards: Exploring Math With Your Kids

Grades K-6
1996
Author: Jan Mokros & TERC

Ordering Information
Greenwood Publishing / Heinemann
Educational Books Inc.
88 Post Road West
PO Box 5007
Westport, CT 06881
(603) 431-7894 / Fax: (800) 203-1502
Toll-free:(800) 793-2154
Email: custserv@heinemann.com
www.greenwood.com

$16.95 per book

Standards: NCTM Curriculum and Evaluation Standards (1989); NCTM Professional Standards (1991)

This book, written for parents of students in grades K to 6, exposes the myth that there are those who learn to do math easily and those who are doomed never to experience success in math. This book offers parents practical ways to provide children with needed practice in math, along with a collection of games and activities that encourages children to become successful math learners. The book explains to parents how the activities relate to mathematics, what is reasonable to expect a child to understand, and how to ask questions that prompt and support mathematical learning. Activities range from the playful to the serious. In one activity, children count stoplights, determining how many were red when drivers arrived at them and how long the lights stayed red. This collection of exercises is intended to foster mathematical literacy. (Author/LDR) ENC-008967

Sunlight, Skyscrapers, and Soda-Pop: The Wherever-You-Look Science Book

Grades K-6
1996
Publisher: Learning Triangle Press
Author: Andrea T. Bennett, James H. Kessler

Ordering Information
American Chemical Society
Department 1195
1155 16th Street NW
Washington, DC 20036
(800) 209-0423 / Fax: (202) 872-6067
Toll-free:(800) 227-5558
www.acs.org/edresources.html

$12.95 per activity book (paperback)

This book contains hands-on science activities that are designed for students and an adult partner. It follows siblings Sally and Sammy through their day as they realize that there are interesting scientific phenomena all around them. Each pair of activities begins with a picture of Sally and Sammy in an everyday situation as they describe in rhyme their observations. For example, while they are in the kitchen fixing breakfast, an egg breaks on the floor. One of the activities that accompanies this scenario allows the students to discover the strength of the dome shape of eggshell halves. The characters in the book challenge the readers to find in other scenarios examples of the tested scientific principles. The strength of the dome activity is demonstrated in a picture of the ball park with one of the characters sitting on a batting helmet. Answers to the science search challenge and explanations of the hands-on activities are provided at the end of the book. (Author/JR) ENC-015498

Teaching Science with Everyday Things

Grades 2-6
1995
Author: Victor E. Schmidt, Verne N. Rockcastle

Ordering Information
AIMS Education Foundation
PO Box 8120
Fresno, CA 93747
(559) 255-4094 / Fax: (559) 255-6396
Toll-free: (888) 733-2467

$16.95 per book (paperback)

This activity guide provides elementary science teachers with hands-on activities using common, everyday things. The purpose of the book is to be of practical help to teachers in teaching science with no special or costly equipment. The text is structured in 14 chapters that cover such topics as counting and measuring, air and weather, and powders and solutions, as well as environment and conservation, forces and motion, and Sun, Moon, and stars. Each chapter contains a statement of objectives in three categories (attitudes and appreciations, skills and habits, and facts and principles) and hands-on activities. Each hands-on activity includes background information, a list of materials, and procedures, as well as sample discussion questions. In sample activities, students make a bottle barometer by putting an inverted bottle with a long slender neck in a jar of water, build a simple magnetic compass by laying a magnetized needle on a piece of aluminum foil on a water bowl, and make a magnifier by catching a drop of water in a loop of a thin wire. The book features cartoon illustrations that show procedures and instructions detailed in the text. It also includes bibliographic references and an index. (Author/YK) ENC-015984

The Science Chef Travels Around the World: Fun Food Experiments and Recipes for Kids

Grades 2-8
1996
Author: Joan D'Amico, Karen Eich Drummond

Ordering Information
John Wiley and Sons, Inc.
One Wiley Drive
Somerset, NJ 08875
(908) 469-4400 / Fax: (732) 302-2375
Toll-free: (800) 225-5945
www.wiley.com

$12.95 per activity book (paperback)

This book helps students become international science chefs as they integrate their study of geography, science, and food. Readers learn about the foods and cultures of fourteen countries, perform hands-on science experiments, and prepare international dishes. Each chapter begins with a regional map and a discussion of the foods and meals of that country. Science experiments that can be conducted in the kitchen are followed by recipes that contain the foods tested in the experiments. Each experiment includes a purpose statement, a list of materials, and a set of directions. An explanation of the results is included. A scale from one to three chef hats indicates the cooking experience needed to prepare the recipes. The book provides explanations of cooking tools, skills, and safety rules. General nutrition information is supplied, and a table lists the nutrient content of all of the recipes. A glossary contains culinary and scientific terms. (Author/JR) ENC-016386

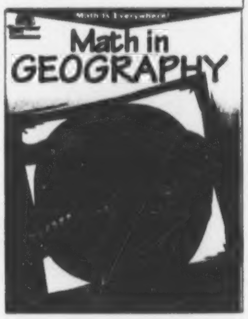
Math in Geography

Math Is Everywhere! Series

Grades 4-6
1994
Author: Tom Nelson

Ordering Information
Evan-Moor Educational Publishers Co.
Orders
18 Lower Ragsdale Drive
Monterey, CA 93940
Fax: (800) 777-4332
Toll-free:(800) 777-4362
www.evan-moor.com/

$8.45 per book



This book, for fourth through sixth grade teachers, is one of a series of math-based, hands-on thematic units. Children apply math concepts and skills to home and school situations. The units include teacher resource pages, student forms for recording information, activity sheets, and patterns. This unit intends to engage students in a variety of mathematical applications to the study of geography. Students make their own globes; measure distances on maps and globes; investigate world time; and explore direction, longitude, and latitude. Also available from this series is *Math in the Kitchen* for grades 2-3, which includes recipes and activities related to the kitchen and cooking. Children also explore cost comparison for grocery items and are introduced to the power of advertising. (Author/SXA) ENC-007453 & ENC-007450

Great Moments in Science: Experiments and Readers Theatre

Grades 4-9
1996
Author: Kendall Haven

Ordering Information
Teacher Ideas Press/ Libraries Unlimited
PO Box 6633
Englewood, CO 80155
(303) 770-1220 / Fax: (303) 220-8843
Toll-free: (800) 237-6124
www.lu.com/

$24.50 per activity book (paperback)

This book contains scripts for scenarios that depict historic discoveries by male and female scientists, experiments related to the discoveries, and lists of additional references. The author's goal is to help students connect abstract concepts with the flow of human drama and history. When the students act out the scenarios, the topics become relevant within a historical context. The activities represent twelve significant events in science and were selected because of their relevance to classroom teaching, theatrical potential, and affordability. One chapter covers how Louis Pasteur handled the debate about whether spontaneous generation occurs or not. The students perform a skit in which Pasteur is trying to balance his administrative duties with his battle to discredit Felix Pouchet's claim that microscopic organisms appear without parents during fermentation and putrefication. Pasteur and his student model the scientific patterns of thought and process skills when they discuss his experimental designs and results. The related experiments that the students conduct involve testing the conditions that optimize mold growth. They look for sources of error, reflect on their observations, and consider what their results mean. References for further reading are included. (Author/JR) ENC-016071

Measurement in Motion
Learning in Motion Series

Grades 5-12
1997
Author: Marge Cappo, Michael Fish; programmer, Andrew Green

Ordering Information
Learning in Motion
500 Seabright Avenue, Suite 105
Santa Cruz, CA 95062
(831) 457-5600 / Fax: (831) 459-6876
Toll-free: (800) 560-5670
Email: helpdesk@learn.motion.com
www.learn.motion.com

$129.00 per CD-ROM package (Macintosh)

Note: Includes 1 CD-ROM, 1 installation computer disk with 1 back up disk and 1 teacher's guide. Contact vendor for quantity discounts and system requirements.

This kit contains software and a teacher's guide with activities that enable students to mathematically and scientifically analyze motions that are common in their lives. The authors state that in both math and science, connecting different mathematical representations builds deeper understanding. This kit is designed to let students directly connect concrete situations in movies to visual data representations in graphs and charts, and to symbolic representations in data tables and formulas. The kit contains installation software, a CD-ROM, and a teacher's guide. The CD-ROM has video segments of real-life occurrences, such as a candle burning, cars passing on the street, or the movement of amusement park rides. Teachers or students can capture motions that they want to study and use the software with digitized movies that they create. Students direct the computer to take measurements such as area, angles, and lines, while the program keeps track of the time. They decide how they want to display their data and whether they want to add text. The CD-ROM also contains two investigation webs that connect a set of related investigations. These webs offer the users several suggested paths while they study variations of motion with the same object. The activities in the teacher's guide explore the scientific and mathematical content, while stimulating the students to think of other questions or applications in different situations. Each activity lists the learning objectives, national standards, and the problem for investigation as well as discussions of the results and extensions of the lessons. Reproducible student pages are provided. A reference section in the teacher's guide offers technical help for the applications in the computer program. (Author/JR) ENC-016600

Decision-Making Scenarios

Learning About Learning: GEMS Teacher's Guide
GEMS series

Grades 6-8
1996
Author: Jacqueline Barber, Katherine Barrett, Kevin Beals, Lincoln Bergman, Marian C. Diamond

Ordering Information
GEMS
University of California, Berkeley
Lawrence Hall of Science #5200
Berkeley, CA 94720
(510) 642-7771 / Fax: (510) 643-0309
www.lhs.berkeley.edu

$25.50 per book

This series of teacher's guides contains guided discovery activities with step-by-step instructions and background information to allow presentation by teachers without special background in math or science. This teaching unit consists of activities to help students in grades 6 to 8 learn about learning from several different perspectives. Topics include the human organism, animal behavior, health and safety, product testing, the ethics of experimentation, and what scientists do. In addition to providing a way to study these important content areas, this unit enables students to learn more effectively as they continually reflect on their own learning process. While doing the activities in this book, students study how individual humans and animals learn; make tactile mazes of sticker strips; test mazes on a blindfolded partner; explore how humans and animals learn by using sensory information from their environment; learn how to solve two health related mysteries based on true stories; and investigate how animals and humans learn what is safe to eat and learn why there is a need for regulation of foods, drugs, and cosmetics. A Behind the Scenes section serves as an introduction to the topic of learning and the human brain; a Summary Outlines section serves as a teacher guide. Also included are student outcomes, assessment suggestions, literature connections, and a resource section. (Author/CCM) ENC-008092

No Quick Fix: A Problem-Based Unit
Problem-Based Science Units

Grades 6-8
1997
Author: The College of William and Mary, School of Education, Center for Gifted Education

Ordering Information
Kendall/Hunt Publishing Company
4050 Westmark Drive
PO Box 1840
Dubuque, IA 52004
Fax: (800) 772-9165
Toll-free: (800) 770-3544
www.kendallhunt.com

$32.95 per book (paperback)

Standards: Benchmarks for Science Literacy; National Science Education Standards (December 1995); Standards of Learning for Virginia Public Schools (June 1995)

This curriculum unit is designed to introduce high ability students to immunology and microbiology as they grapple with an ill-structured, real-world problem. The series comprises a supplementary curriculum designed to integrate science process, content, and the concept of systems through the study of real-world problems. Each unit is organized around a central problem that is mapped out into specific lessons with assessment approaches that include problem logs, experimental design worksheets, and lab report forms. This unit contains fifteen lessons that vary in length between one class session to two or three weeks. The students begin this unit by assuming the role of a physician who must develop an action plan to control a potential outbreak of tuberculosis. In the first lesson, students work together to create a Need to Know Board that outlines what they already know, what they need to know, and how they can find required information. In the next lesson, students learn about the concept of a system and apply it to the human body. In subsequent lessons, students create a diagram of the immune system and study microscope slides of the thymus, spleen, and lymph nodes as well as samples of normal and tubercular lung tissue. For each lesson, the guide provides a summary of the lesson length, its instructional purpose, and required materials and handouts. It also provides a list of discussion and hands-on activities for each class session, questions for

the teacher to ask, and suggested assessments and extension activities. Reproducible student readings and worksheets are included, as well answer keys, scoring rubrics, and sources for supplies. The bibliography includes a listing of curricular correlations and electronic resources. Also available from this series is *Electricity City,* in which students are introduced to electricity as they work to meet the electrical needs of a planned recreational complex being built in the middle of a city. (Author/LCT) ENC-014776 & ENC-014779

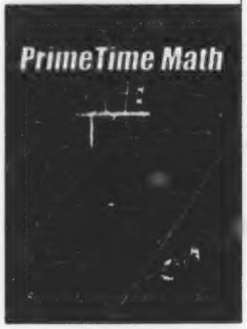
Emergency
PrimeTime Math Series

Grades 6-8
1997
Author: Todd Zaorski, Elizabeth Hurley, Sami Ackerman, Max Coniglio, Chris Georgenes

Ordering Information
Tom Snyder Productions, Inc.
80 Coolidge Hill Rd
Watertown, MA 02172
Fax: (617) 926-6222
Toll-free: (800) 304-1254
www.teachtsp.com

$79.95 per CD-ROM package (Mac/Windows)
Note: Contact publisher for system requirements.

Standards: NCTM Curriculum and Evaluation Standards (1989)



This CD-ROM, one of six interactive software products available in the Prime Time Math series for middle school grades, presents the dramatic story of the work of a medical team treating a fifteen year-old patient in an emergency room. Software guides the students, working in groups, through the first two acts, which involve them in the problem-solving scenario. They follow a sequence of activities: learn which data to collect, watch the video twice, work on individual and group math problems, share answers, and have a group review of the answers. Functioning as a team is planned into the lesson sequence and considered a primary objective. Act three is a short video resolution to the drama. The mathematics covered includes conversions of metric units and equivalents, medical measurements and rates, and graphs of values over time. This CD-ROM unit takes two to four class periods to complete and comes with a Teacher's Guide containing learning objectives, reproducible masters of student materials, and an answer key. There are optional homework assignments, suggestions for how to evaluate the unit, and ideas for extensions into real-world applications. Also available from this series is Fire, which presents the story of a team of firefighters at the scene of a fire. In the problem-solving scenario, students use formulas applying basic algebra, order of operations, measurements and rates, and the Pythagorean Theorem. (Author/JRS) ENC-011939 & ENC-011356

Prentice Hall Product Testing Activities

Grades 6-8
1993
Author: editor, Anita Holmes

Ordering Information
Prentice Hall School Division
1 Lake Street
Upper Saddle River, NJ 07458
Toll-free: (800) 848-9500

$19.97 per teaching guide (paperback)
$12.97 per student databook (paperback)

This activity book and accompanying teaching guide, designed by *Consumer Reports* magazine, presents 18 product-testing activities that help students develop a healthy skepticism about the world of consumer goods. The testing activities in this program involve not only hands-on encounters with many science concepts, but also general scientific methods, such as data collection, analysis, and experimental controls. Sample testing products include antacids, bubble gum, and jeans, as well as orange juice, shampoos, and yogurts. For example, through testing antacids (or shampoos or yogurt), students learn about acids and bases; and by testing sports drinks they are introduced to ions, salts, and the body's digestive and metabolic processes. Each activity includes focus questions, a statement of objectives, and a list of materials. Each activity in the Student Databooks begins with step-by-step tests, and ends up with activities that have students design the test procedures. Students are also encouraged to send test results to Consumer Reports, using a form that is provided on the last page of each unit in the teaching guide. The teaching guide includes an introduction and troubleshooting tips and covers how to use this program. It also includes discussion questions with answers and suggestions for extensions. A science concept index is provided in the teaching guide. (Author/YK) ENC-015442

The Power of Numbers: A Teacher's Guide to Mathematics in a Social Studies Context: An Interdisciplinary Curriculum

Grades 6-9
1993
Author: Fred E. Gross, Patrick Morton, Rachel A. Poliner

Ordering Information
Educators for Social Responsibility (ESR)
23 Garden Street
Cambridge, MA 02138
(617) 492-1764 / Fax: (617) 864-5164
Toll-free: 800) 370-2515
Email: educators@esrnational.org

$28.00 per teacher's guide (paperback)
$12.00 per student handouts packet

Standards: NCTM Curriculum and Evaluation Standards (1989)

This guide for an integrated mathematics and social studies curriculum contains lesson plans and activities for learning math in the context of real-world decision making. Contexts include polling, studying trends in census data, and designing a public rail transportation system for Los Angeles. Students work on thematic projects that require reasoning and communication skills as they apply quantitative techniques in social studies. Each lesson plan contains teacher questions for guiding class discussion, relevant mathematics information, and answers, with explanations, for all activities. The lessons may be used sequentially or selectively. The guide also includes assessment suggestions, an appendix on cooperative learning techniques, and a reference list. A student handout packet is included with the guide. The curriculum activities are correlated with the National Council of Teachers of Mathematics *Curriculum and Evaluation Standards for School Mathematics* (1989). (Author/JRS) ENC-014176

Math in Daily Life: How Do Numbers Affect Everyday Decisions?
www.learner.org/exhibits/dailymath/

Grades 6-12
1998
Author: Janice Hadfield, Betsy Teeple; project manager, Jennifer Fleming

This web site, part of the Annenberg/CPB Project Exhibits Collection, explores how math principles can be helpful when deciding whether to buy or lease a car, following a recipe, or decorating a home. The site is organized into six themes that describe mathematical concepts and offer hands-on application activities. As an example, the section Playing to Win explains how to find mathematical probability and describes how these rules define long-term outcomes for gambling casinos. In another section, Population Growth, there is a hands-on activity for calculating simple and compound interest on retirement savings, along with information about different ways to communicate data visually. A bibliography and links to other mathematical web sites are also provided. Winner, ENC Digital Dozen, March 1999. (Author/JRS) ENC-014301

Pooling Around
Math at Work Series

Grades 7-10
1997
Publisher: Center for Occupational Research and Development
Author: John Chamberlain, Katie Fisher, Becky Ikenberry, Eric Lee, Donovan Mandap, Barry Sohl, Bill Snyder, Quicksilver Software, Inc.

Ordering Information
CCI Publishing
324 Kelly Drive
PO Box 21206
Waco, TX 76702
(254) 776-1822 / Fax: (254) 776-3906
Toll-free: (800) 231-3015
www.educatalog.com

$40.00 per CD-ROM package
$150.00 per CD-ROM 5-pack
Note: Contact publisher for information about site licenses and system requirements.

This CD-ROM is an interactive simulation in which the players take the role of general contractors in developing and managing the construction of a swimming pool or spa. Through interactive games, the series applies basic principles of pre-algebra, algebra, and geometry to the real world through workplace applications. According to the creators, the games are designed for people who are interested in thinking mathematically and in developing business sense. In this game, the player schedules the subcontractors and proceeds through six stages of construction: surveying and excavation, structural forming, concrete, deck and tile, plaster, and landscaping. Before each stage the player must provide information about the amount of material or equipment that is needed. In the excavation stage, for example, players calculate perimeter of the pool, the amount of sod that can be salvaged prior to excavation, and the number of truckloads of dirt that will be removed for the hole. There are two levels of play: learning level and real world (with more unexpected problems). On-screen guidance is offered by a mentor who also monitors performance in terms of schedule, budget, and customer satisfaction. Players use skills that include finding area and volume. Extensions and related activities are included in the accompanying brochure. (Author/JRS) ENC-012682

A Problem of Life and Death: The ECMO Saga
ThinkSharp Learning Experience Series

Grades 7-12
1999
Author: ThinkSharp, Inc.

Ordering Information
Think Sharp Inc.
539 Rock Spring Road
Bel Air, MD 21014
(410) 893-5338 / Fax: (410) 893-5820
Toll-free: (888) 844-6520
www.sharpthinkers.com

$699.00 per kit (includes teacher's guide, video, and CD-ROM)
Note: Include 5% S&H.

Standards: NCTM Curriculum and Evaluation Standards (1989)

This kit contains multimedia materials for a four part program in which students apply data analysis techniques to determine which newborns are good candidates for treatment with a risky, yet potentially lifesaving, heart lung bypass therapy. The series offers supplementary mathematics programs that aim to motivate students with video presentations, creating a real-world context for open-ended problem-solving activities. A teacher's guide for each program in the series describes the goals and offers background information along with teacher preparation instructions and assessment guidelines. In the video for Part One of this program, students see a helicopter delivering a newborn baby in respiratory distress to a hospital and learn about the baby's situation. Scenes from the hospital highlight the urgency of the information explaining what Extracorporeal Membrane Oxygenation (ECMO) therapy is and in what situations it is typically used. Students, working in groups, are given a diagram of the ECMO heart lung pump, data from the early 1980s about babies with severe respiratory illness, and definitions related to the data. Seven data elements are given for each baby. Students are challenged to determine which of these elements can be used to separate survivals from deaths. The goal is to specify, on the basis of the data, a subset of the 30 babies that have a less than 20% chance of survival; these babies would be considered reasonable candidates for the ECMO therapy. Each student group is responsible for a five-minute presentation about their conclusions. In Part Two, students view the next segment of the video describing the benefits and risks of incubator and ECMO therapies. Stem-and-leaf diagrams and box plots are introduced as techniques for helping to determine which data elements most closely correlate to infant deaths. The student groups construct diagrams for the data elements and present their solutions to the class. In the final two parts, students use scattergrams to make medical decisions and learn about the international controversy surrounding medical testing procedures. Also included with this program is a CD-ROM with an interactive interview with a doctor answering frequently asked questions concerning ECMO therapy along with an animation showing how ECMO therapy works and an account of one child's experience and successful therapy outcome. Activities are correlated to the NCTM *Curriculum and Evaluation Standards for School Mathematics* (1989). (Author/JRS) ENC-016737

Decisions Based on Science

Grades 9-12
1997
Author: Vincent Campbell, Jocelyn Lofstrom, Brian Jerome

Ordering Information
National Science Teachers Association (NSTA)
PO Box 90214
Washington, DC 20090
(703) 243-7100 / Fax: (703) 522-6091
Toll-free: (800) 722-6782
Email: science.scope@nsta.org
www.nsta.org

$16.75 per book
Note: NSTA member price; $19.95 per book non-member price

Standards: National Science Education Standards (December 1995)

This book contains lessons and activities designed to help students use scientific information to make everyday decisions. The book is divided into three parts. Part One provides an overview for teachers, including background information on decision making, introductory activities, teaching tips, presentation ideas, and a teaching plan. Part Two contains guided activities with student and teacher pages, and Part Three contains independent exercises that suggest additional topics for practicing the skills students have learned. Topics include biotechnology, environmental conservation, and energy use. In a sample case study, students read background information about the effects of chlorofluorocarbons (CFCs) and discuss how CFCs should be regulated. As students develop their decision making skills, they brainstorm ideas, make notes on their ideas and research, and record their conclusions in journals. Notes on using journals as assessment and sample grading rubrics are provided in the appendices as well as information on national standards, bibliographic references, and Internet resources. (Author/LCT) ENC-012221

BEST COPY AVAILABLE

Mathematics for Decision Making in Industry and Government. High School Modules
mie.eng.wayne.edu/faculty/chelst/informs

Grades 9-12
1997
Author: webmaster, Azriel Chelst; editors, Kenneth Chelst, Tom Edwards, Frank Trippi

This web site contains real-world applications of linear programming in teacher-friendly modules. The site, developed and maintained as a joint project of the Industrial and Manufacturing Department at Wayne State University and the Institute for Operations Research and the Management Sciences, aims to motivate students to learn mathematics by demonstrating ways in which the mathematics they are learning is actually used in industry and government. Two modules in this site provide supplementary material related to using systems of linear inequalities in linear programming for problems involving worker scheduling and product mix. The modules are designed as self-contained supplements to the high school curriculum with the basic material suitable for introductory algebra and the extensions to be used for more advanced grade levels. In addition to the teaching modules, this site contains brief histories of operations research and linear programming, as well as short case studies showing the use of linear programming to solve problems in industries around the world. Case studies include the Nabisco Company, production for farmers in China, and the lumber industry in Mexico. (Author/JRS) ENC-011878

Integrated Mathematics and Science

Project Explorer: An Orangewood Elementary and ASU West Collaborative Project
coe.west.asu.edu/explorer

Grades K-6
1998
Author: Orangewood Elementary staff and ASW West preservice education students

Standards: NCTM Curriculum and Evaluation Standards (1989).

This web site presents integrated math and science units and activities. The material was developed at a two-week staff development workshop for teachers held during the summer of 1997. The workshop goal was for the teachers, working in teams, to experience current techniques for mathematics-based integrative instruction and then apply these principles as they designed curriculum for a two-week summer camp that immediately followed the workshop. This web site contains six teaching topics, each containing a section overview, professional development resources, and the teacher-created resources. The activities emphasize a hands-on approach; develop the mathematics from the NCTM *Curriculum and Evaluation Standards for School Mathematics* (1989) in science contexts; and incorporate language arts and technology tools to enhance learning. (Author/JRS) ENC-013759

Secret Codes
MESA Series

Grades 6-8
1997
Author: Nancy Cook; developed by Washington MESA

Ordering Information
Dale Seymour Publications
4350 Equity Drive
PO Box 2649
Columbus, OH 43216
(800) 237-3142 / Fax: (800) 393-3156
Toll-free:(800) 231-3106
www.pearsonlearning.com

$20.95 per book (paperback)

Standards: NCTM Curriculum and Evaluation Standards (1989); NCTM Professional Standards (1991); Project 2061 (1985)

In this book, students explore the mathematics involved in cryptology by devising, enciphering, and deciphering codes. The cross-curriculum series combines essential pre-algebra topics with hands-on science explorations to motivate students in both areas of study. Using materials and group collaboration to solve open-ended problems, students are encouraged to make connections between classroom and real-world applications through links to writing, history, technology, and careers. In this module, the focus is on modular arithmetic and equivalency. Each activity begins with an overview page summarizing what students are doing and how the teacher needs to prepare. This is followed by background information for the teacher's use and a detailed description of the activity, along with suggested discussion questions and assessment strategies. Also included are project ideas for students to complete with their families. The discussion questions challenge students to investigate why prime numbers play a significant role in sophisticated cryptic systems, and why modular arithmetic is called remainder arithmetic. Each module also includes materials lists, blackline activity masters, and transparency masters. Also available from this series are In the Wind, which focuses on vectors and the theory of flight, and Designing Environments, which looks at scale drawing, proportion, and area-perimeter relationships. (Author/YK) ENC-014234, ENC-014235 & ENC-014438

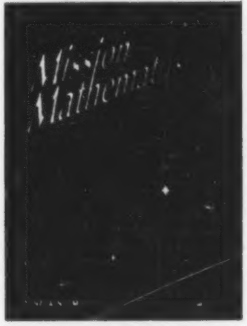
Mission Mathematics, Grades 9 to 12.
NASA/NCTM Project

Grades 9-12
1997
Author: editor, Peggy House

Ordering Information
National Council of Teachers of Mathematics, Inc.
1906 Association Drive
Reston, VA 20191
(703) 620-9840 / Fax: (703) 476-2970
Toll-free: (800) 235-7566
Email: orders@nctm.org
www.nctm.org

$21.95 per set (includes book + 3 posters)

Standards: NCTM Curriculum and Evaluation Standards (1989); NCTM Professional Standards (1991); NCTM Assessment Standards (1995)



This teacher's book, a collaborative effort of the National Aeronautics and Space Administration (NASA) and the National Council of Teachers of Mathematics (NCTM), provides classroom-tested activities involving selected aerospace topics illustrating how science can develop mathematical thinking. These activities provide students with models to help them conceptualize the magnitudes of measurements in aerospace applications. The activities reinforce ratio and proportion concepts and afford opportunities to apply estimation strategies, proportional reasoning, and topics from discrete mathematics. A sample unit presents the mathematics underlying the Global Positioning System (GPS). It develops a conceptualization of GPS through examples in one, two, and three dimensions, identifies the mathematics inherent in the systems, and offers a series of activities. The instruction in these activities is based on the NCTM *Curriculum and Evaluation Standards for School Mathematics* (1989), *Professional Standards for Teaching Mathematics* (1991), and *Assessment Standards for School Mathematics* (1995). Three posters describing binary trees and cryptography; satellite orbits and Kepler's laws of motion; and position, navigation, and the GPS are included. The teacher's book provides teaching suggestions and solutions to the student pages. Materials from this series are also available for grades K-6 and 5-8. (Author/LDR) ENC-010961

Mathematics in Biology

www.bio.brandeis.edu/biomath/top.html

Grade 11 and up
Author: Geoffrey Dixon, Steven Karel, Frank Lonberg, and Mike Casey

This web site, created at Brandeis University, offers concrete interactive simulations of scientific concepts that are applications of advanced mathematics topics. Advanced level mathematics is required to explain the mechanism supporting the development of each scientific concept. Mathematics topics include exponential growth, the derivative, logarithms, differential equations, and partial derivatives. Interactive models for population growth, with and without predators, feature probabilities that the viewer can adjust to create an animation. Also found at this site are simple and complex simulations with graphs for the propagation of disease. The population and disease simulations are based on using differential equations to model the scientific process. Included is an explanation of the mathematics that supports each simulation. There is a note to high school students and teachers about the importance of mathematics for the study and understanding of modern biology. Links to other sites that illustrate the connection between science and mathematics are provided. (Author/JRS) ENC-013226

At Play: Sports and Toys

Sport! Science @ The Exploratorium

www.exploratorium.edu/sport/index.html

Grades K-12
Author: Jim Spadaccini

This web site, published by the Exploratorium, highlights the science and technology of sports. The Exploratorium is a museum with more than 650 science, art, and human perception exhibits, many of them online. This exhibit contains sections about baseball, bicycling, skate boarding, and hockey as well as articles about the impact of science on athletic endeavors. Each sport section explains the laws of physics that need to be considered in the athletes' strategies, the physiological factors that impact their performances, and the materials and design involved in the construction of sports equipment . Each section has video clips that show authorities in athletics and science explaining aspects of the sport. Interactive activities allow site visitors to explore concepts such as the variables involved in hitting a home run or the aerodynamic drag and propulsive power of a cyclist. Hands-on activities, such as the clothespin workout to demonstrate muscle fatigue, are found throughout the site. Students use mathematical skills to make calculations such as reaction times and gear ratio. Questions are answered, such as why muscles burn after exercise. (Author/JR) ENC-016069

Gizmos and Gadgets: Creating Science Contraptions That Work (And Knowing Why)

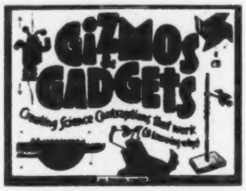
Williamson Kids Can Series

Grades 2-9
1999
Author: Jill Frankel Hauser

Ordering Information
Williamson Publishing
PO Box 185
Charlotte, VT 05445
(802) 425-2102 / Fax: (800) 304-7224
Toll-free: (800) 234-8791
Email: orders@williamsonbooks.com
www.williamsonbooks.com

$12.95 per activity book (paperback)

This activity book provides instructions for making 75 contraptions that demonstrate such physical principles as friction, gravity, energy, and motion. Readers learn how to make a catapult that sends marshmallows flying and a toy bird that balances on a finger from materials found around the house and in the garage. The book is organized into chapters for motion and friction, gravity and balance, and torque and energy. Each chapter begins with a brief introduction to the concept and contains directions for building four or five contraptions that illustrate how it works. For example, the chapter on spinning (rotational inertia) describes how to build a simple top from a pencil and various shapes of cardboard. Readers then try to improve the spin by adding weights and using a string to add torque. Each activity becomes slightly more complex until students are building a rink where their tops appear to defy gravity and designing boomerangs and pie plate Frisbees. Each activity includes additional scientific explanations and examples of real-life applications. (Author/LCT) ENC-016481



Exploring Energy with TOYS: Complete Lessons for Grades 4-8

Teaching Science with TOYS Project

Grades 4-8
1998
Author: Beverley A.P. Taylor

Ordering Information
Terrific Science Press Center for Chemical Education
Miami University Middletown
4200 E University Blvd
Middletown, OH 45042
(513) 727-3269 / Fax: (513) 727-3328
Email: cce@muohio.edu

$19.95 per book (paperback)

Standards: National Science Education Standards (December 1995)

This book, published as part of the NSF-funded Teaching Science with TOYS project, provides teachers with ideas on how to use toys as teaching tools through 21 physics activities. The goal of the TOYS project is to enhance teachers' knowledge of chemistry and physics and to encourage the use of activity-based, discovery-oriented science instruction. The topic of this module is mechanical energy and energy conversions. The module is organized into three main sections that provide a review of mechanical energy concepts; pedagogical strategies for teaching a unit on mechanical energy; and module activities in which complete instructions for conducting each activity are provided. Each activity contains background information, procedures, and guidelines for class discussion, as well as suggestions for alternative methods and extensions, strategies for assessment, and ideas for cross-curricular integration. These are followed by a list of further reading and handout masters in which masters for data sheets and observation sheets are provided. Each activity is correlated with the *National Science Education Standards.* (Author/YK) ENC-014449

Yesterday's Sports, Today's Math

Grades 4-9
Author: Don Fraser

Ordering Information
Dale Seymour Publications
4350 Equity Drive
PO Box 2649
Columbus, OH 43216
(800) 237-3142 / Fax: (800) 393-3156
Toll-free: (800) 231-3106
www.pearsonlearning.com

$15.35 per book

This book is a collection of activity masters that uses sports to help students discover math as they investigate scoring patterns, averages, records, and other statistics. These activities, which use real-world data, aim to teach students number sense while they build math skills. The activities are arranged by sport and vary

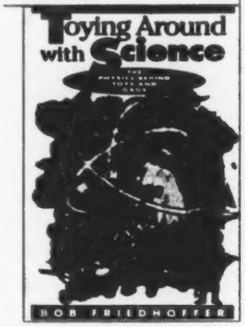
significantly within each sport in terms of difficulty. Sports statistics are provided on the blackline masters for some of the activities. Others require up-to-date statistics for which the sports page of the newspaper is generally a useful source. Statistics for school team sports may also be used for such activities. In a sample hockey activity, students learn how to calculate goals against average and to determine which goalie has the best average. An answer key is provided for those activities that require it. (Author/KFR) ENC-009563

Toying Around with Science: The Physics Behind Toys and Gags

Grades 5-8
1995
Publisher: Franklin Watts and Grolier
Author: Bob Friedhoffer

Ordering Information
Grolier Classroom Publishing Company
Trade Sales
90 Sherman Turnpike
Danbury, CT 06816
(203) 797-3500x3967 / Fax: (800) 374-4329
Toll-free: (800) 621-1115
www.grolier.com

$8.00 per book (paperback)



This text presents detailed background information about how toys work. Throughout the book, the author, who has been performing as a magician for almost thirty years for children, reveals the innermost secrets of toys to teach students basic scientific principles behind toys. Toys covered include air and water pressure toys, magnetic toys, and friction toys, as well as vibration toys, spring powered toys, and windup toys. Using inexpensive toys, students explore how water guns (as small water pumps) work by building the difference in air pressure in a tube; learn about magnetism by pulling a bug in a mug using the attraction between the inner magnet in the mug and the outer magnet in their hands; and investigate how a yoyo moves by converting potential energy to kinetic energy. The text also features black and white illustrations that show inside views of several different types of toys. It also includes a review of the scientific principles, a glossary, and an index. (Author/YK) ENC-016321

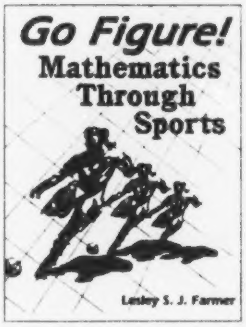
Go Figure! Mathematics Through Sports

Grades 6-12
1999
Author: Lesley S.J. Farmer

Ordering Information
Teacher Ideas Press/ Libraries Unlimited
PO Box 6633
Englewood, CO 80155
(303) 770-1220 / Fax: (303) 220-8843
Toll-free: (800) 237-6124
www.lu.com

$24.50 per book (paperback)

Standards: NCTM Curriculum and Evaluation Standards (1989)



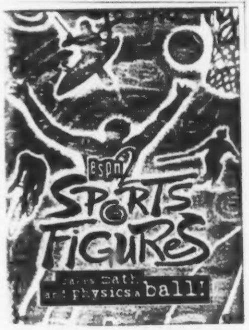
This teacher resource book blends mathematical concepts and information research in activities based on sports themes. The book covers five major topics, each with its own mathematical focus. Measurement concepts are developed in the context of physiology, a sports training context is offered for math functions, and a how to play the game unit highlights geometric ideas. The sports competition unit focuses on using statistics, and the last unit examines sports economics, emphasizing data representation. The multiple lessons found in each unit contain single concept warm-up activities and more extensive open-ended projects. Other lesson activities include extensions and brainteasers. The introduction explores the rationale for providing context-rich, complex learning experiences that encourage students to think creatively about mathematics. It also explains how the material supports the National Council of Teachers of Mathematics (NCTM) *Curriculum and Evaluation Standards* (1989) and the basic tenets of the NCTM's draft 1999 process standards. In a sample activity, students choose a sport, determine a variable by which to compare two sets of records data, and research the sport's record-breaking history. The final project for this activity consists of a graph for the two sets of data, a mathematical function describing the trends observed in the data, and an analysis of the data including predictions for future records. Students are assessed on the accuracy of the graphs and functions and on the mathematical rigor of the analysis and predictions. (Author/JRS) ENC-016377

Sailing Through Bernoulli
SportsFigures Series, 1998-99

Grades 9-12
1998
Author: A. Dean Bell; co-producer, Holly Faison

Ordering Information
ESPN Cable in the Classroom Department
ESPN Plaza
Bristol, CT 06010
(860) 585-2000

$40.00 per 1998-99 series (7 videotapes/16 programs; 1 guide)



This video segment, developed for grades 9 to 12 as part of the Sports Figures video series, explains how Bernoulli's principle is used to propel a sailboat faster than the wind. The video series presents 14 lessons meant to stimulate student interest in mathematics and physics by showing the connections of these subjects to sports. Each videotape contains two or three lessons featuring top professional athletes who demonstrate how mathematical and physical principles are used in sports. This segment features World Cup skipper Scott Dickson who demonstrates why a sailboat moves faster when it is positioned perpendicular to the wind. The second segment on this tape is called How Sweet It Is (ENC-015097) and explains how standing wave patterns lead to the sweet spot effect known to baseball hitters. It features Atlanta Braves third baseman Chipper Jones who demonstrates that when the ball hits the sweet spot of a baseball bat, the athlete feels no force or vibration on his hands and the ball seems to take off with extra speed. The teacher's guide provides a lesson plan and activity sheet for each of the video segments. Each lesson summarizes the academic topics and provides background information and ideas for extending the lesson. An activity sheet contains additional problems and open-ended discussion questions. (Author/LCT) ENC-015096

Construction and Design

Under Construction

AIMS Activities Series, Grades K-2

Grades K-2
1997
Author: Carol Gossett; editor, Betty Cordel

Ordering Information
AIMS Education Foundation
PO Box 8120
Fresno CA 93747
(559) 255-4094/ Fax: (559) 255-6396
Toll-free: (888) 733-2467

$16.95 per activity book (paperback)

Standards: Benchmarks for Science Literacy (1993); National Science Education Standards (December 1995); NCTM Curriculum and Evaluation Standards (1989)

This book contains hands-on activities that encourage students to apply the use of technology in making constructions for themselves as well as for characters from children's literature. The trial-and-error nature of the activities helps students understand that failures are opportunities to learn and promotes the notion of life-long learning. The AIMS Activities Series integrates mathematics and science with other curriculum areas including language arts, social studies, physical education, art, and music. This book presents 26 activities, which broaden in scope as students progress through them. Each activity lists key questions, corresponding national standards, and integrated disciplines as well as procedures and materials. In one activity, students explore different designs of can openers, analyzing the purpose of the can openers and peoples' motivation to change them. Tables show how the Project 2061 *Benchmarks for Science Literacy*, the *National Science Education Standards*, and the National Council of Teachers of Mathematics *Standards* are met. Reproducible handouts are found throughout the book, and a bibliography is included. (Author/JR) ENC-015981

LEGO Crazy Action Cpntraptions: A LEGO Inventions Book

LEGO TECHNIC Series

Grades 2-12
1998
Publisher: Klutz and LEGO
Author: Don Rathjen and the editors of Klutz

Ordering Information
Pitsco LegoDacta
P O Box 1707
Pittsburg, KS 66762
Fax: (888) 534-6784
Toll-free: (800) 362-4308
www.pitsco-legodacta.com

$19.95 per kit (LEGO TECHNIC pieces and book)

This kit contains the materials and directions to construct ten action contraptions. Students can build five of the contraptions with the LEGO pieces included in the kit. The other five require additional LEGO pieces and household items such as string, rubberbands, and ping pong balls. The directions are presented in a spiral-bound book with ingredients lists, stepwise directions, and color photographs illustrating how the pieces fit together. In one of the sections, students learn how to construct The Never-Look-Back Machine, in which two photographs of children are affixed to gears on a spinning beam. No matter how fast the machine is whirled around or the gears move, the backs of the photos are never seen. The book explains that this is analogous to the movement of Earth and the moon and demonstrates why the face of the moon is always facing toward Earth. (Author/JR) ENC-016707

Roamer Control Pack

Grades 4-8
1990
Author: Valiant Technology Ltd.

Ordering Information
Valiant Technology
Dimensions in Learning, Inc.
PO Box 638
Forest Park, IL 60130
(708) 366-6117 / Fax: (708) 366-8348
Toll-free: (888) 366-6628
www.valiant-technology.com

$279.95 per Roamer
$335.00 per Roamer control pack
Note: Pack includes 1 each of Control box, Light, Sensor, and Motor packs. Components may be purchases separately. Contact vendor for further information.

Students can use this kit, containing a robot, a control pack, and their accompanying guides, to take on the role of robotic engineers. Students decide how the robot (the Roamer) should look, what it should do, and how it should behave as they can choose tasks and determine specifications for the robot's performance. The students explore the logic of programming when they write two kinds of programs to control the Roamer, Go and Procedure programs. By pressing the buttons on the top of the Roamer, they can decide how far the robot will go, how much it will turn in a particular direction, and the sounds it will make. Students are encouraged to decorate the robot as different animals and personalities. The Roamer Control Pack, which contains the control box, sensors, and motor packs, allows the students to broaden the robot's capabilities. The user guides provide sample programming instructions, explanations of the technical components, and advice about control concept instruction activities' management. The activity books contain multidisciplinary suggestions of ways to use the Roamer and its various accessories. (Author/JR) ENC-016783

SenSci Control Box

Grades 4-8
1996
Author: Valiant Technology Ltd.

Ordering Information
Valiant Technology
Dimensions in Learning Inc.
PO Box 638
Forest Park, IL 60130
(708) 366-6117 / Fax: (708) 366-8348
Toll-free: (888) 366-6628
www.valiant-technology.com

$114.95 per kit (PC version)

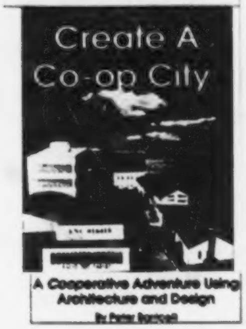
This kit contains activities that teach lessons about circuit design and control programming while the students create a series of three-dimensional games associated with the story, The Adventure of the Golden Oil Can. The projects combine the use of SenSci, Inventa, and Tronix. SenSci is a portable control box with a software package that allows the students to write programming procedures on the computer to control the devices they build. Inventa is a design-and-make system that contains the materials for the students to make their three- dimensional games. Tronix is a system that helps the students learn about electricity and circuit design that they need to build their games. Students build circuits with lights and motors that they control with procedures they have written on the computer. They can use this kit to create projects with up to sixteen procedures. Each procedure is a set of program instructions that makes something happen, such as sounding a buzzer or lighting a light. In one activity, the students learn how to program a motor that turns in two directions and how to use push buttons to start and stop a motor turning. Also available is the Tronix Electricity Class Pack, which provides 20 hands-on activities in which students explore the science of electricity and then apply that understanding in technology projects. It is particularly designed to develop understanding of practical electricity and electric circuits. (Author/JR) ENC-016765 & ENC-016766

Create a Co-Op City: A Cooperative Adventure Using Architecture and Design

Grades 4-12
1997
Author: Peter Barncelli

Ordering Information
J L B Publishers
PO Box 198
Waterville, ME 04903
207) 873-6016 / Fax: (207) 877-8582
Email: jlbent@mint.net
www.designacity.com

$9.95 per teacher's guide (paperback)



This teacher's guide provides step-by-step instructions for designing and building a scale model city in a classroom project that integrates architecture with math, social studies, science, and language arts. Students first learn about one-quarter inch scale drawings and blueprints by drawing an aerial or plan view of their desks or classroom tables in scale. Students next move to creating floor plans and drawing elevations for windows. Working in groups or individually, students design and build a complete house in one-quarter inch scale. When multiple classes are working cooperatively on this city project, each class votes on its favorite design and a 50 scale (one inch equals fifty feet) version of the winning house is built from small blocks of wood cut to the correct scale and shape. Foliage, driveways, and other features are added for additional realism. Students need triangular-shaped architect's rulers to work with the scales used in the project. Suggested activities for this project include visiting an architectural or engineering firm, meeting with a surveyor or lawyer about land use issues, and visiting a construction site. Enrichment ideas and a teacher's bibliography are included. A web site supporting this project is available. (Author/JRS) ENC-016415

Building Toothpick Bridges

Math Projects Series

Grades 5-8
1995
Publisher: Dale Seymour Publications
Author: Jeanne Pollard

Ordering Information
Pitsco LegoDacta
P O Box 1707
Pittsburg, KS 66762
Fax: (888) 534-6784
Toll-free: (800) 362-4308
www.pitsco-legodacta.com

$18.95 per book (paperback)

This book presents a ten-day group project in which students learn and apply abstract concepts such as stress, the law of gravity, and the strength of various geometric shapes. Each five-member group forms a construction company and is responsible for keeping schedules, inventory records, and balance sheets of costs as they design and construct a bridge, using only toothpicks and glue. The object is to build the bridge that sustains the most weight. The book contains background information about bridges, suggestions for setting up the groups, a suggested time schedule, bridge building code, and judging criteria for the completed bridges. Reproducible checks, job duties schedule, warehouse price list, balance sheet, planning paper, and certificate of appreciation are included. (Author/JAR) ENC-016738

Robolab Starter System

Grades 5-12
1999
Author: LEGO DACTA

Ordering Information
Pitsco LegoDacta
PO Box 1707
Pittsburg, KS 66762
Fax: (888) 534-6784
Toll-free: (800) 362-4308
www.pitsco-legodacta.com

$1,875.00 per kit

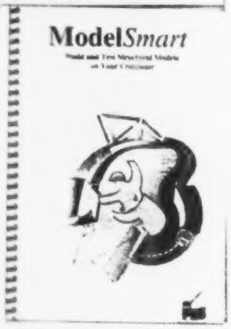
This kit introduces students to robotics design through hands-on activities in which students build real robots using LEGO building elements and program them using ROBOLAB software. The robots are controlled via the RCX (Robotics Command System) microcomputer, which can be programmed using either a PC or Apple Macintosh computer. The RCX then acts independently of the computer so that the robot can behave autonomously. The RCX uses sensors to take input from the environment, to process data, and to turn motors and lamps on and off. The teacher's activity pack contains background information pertaining to the use of the RCX and building set. The information includes a series of activities for whole class participation, copymasters for each project worksheet, and ideas for larger group theme projects. In the whole class introductory activities, students analyze familiar objects to learn how to recognize robots in the world around them and experiment with robotic arms to see how the type of body part affects what a robot can do. Students work in small groups to complete projects in which they build and program a car, a house, a bug, and a gadget. Each activity contains a summary of learning objectives, a discussion with directions for the students, and diagrams of possible solutions as well as reproducible student worksheets and ideas for performance assessments. (Author/LCT) ENC-016736

Modelsmart: A Structural Spreadsheet for Model Builders

Grades 6-12
1996
Publisher: Pre-Engineering Software Corporation (PES)
Author: Robert A. Wolf III and Paul J. Clavier III

Ordering Information
Pitsco LegoDacta
PO Box 1707
Pittsburg, KS 66762
Fax: (888) 534-6784
Toll-free: (800) 362-4308
www.pitsco-legodacta.com

$80.00 per computer disk (Windows) and user's guide
Note: Macintosh version available at same price. School packs, lab packs and net packs also available. Contact publisher for system requirements.



This software enables students to interactively design and test balsa and basswood structural models such as bridges, cranes, and towers on the computer. The software program analyzes the constructed model giving numerical results for the addition of a weight load and can simulate the addition of load and the resulting deflected shape or collapse. Using this software, students are introduced to basic engineering concepts and can explore structural design ideas before building with real materials. Students work with a menu of options beginning with the selection of paper size for the design and including choices for types of support and placement of bars or members in the structure. A load vector or vectors can be added to the completed structure, and the analysis program finds the maximum load the structure can support. The accompanying manual is a reference for the construction options and the various types of output generated by MODELSMART with background information about lateral support and bracing concepts. Also found are details of an ongoing contest challenging students to design the lightest bridge that can support a single load of 100 pounds at the center of an 18-inch span. (Author/JRS) ENC-016753

The Take Off! Kit: An Aviation and Aeronautic Science Kit for Students in Grades 6-12

Grades 6-12
1999
Author: Massachusetts Corporation for Education Telecommunications (MCET)

Ordering Information
Massachusetts Corporation for
Educational Telecommunications
One Kendall Square Building 1500
Cambridge, MA 02139
Fax: (617) 252-5709
Toll-free: (800) 556-4376
www.mcet.edu

$79.00 per kit (teacher's guide, 5 videos, 2 computer disks)
Note: Contact publisher for system requirements.

Standards: National Science Education Standards (December 1995)

This kit, for students in grades 6 to 12, addresses science principles that relate to aviation and aeronautics. The kit contains a five-part video series, an online supplement, and a teacher's guide. The video series TAKE OFF! is based on live satellite broadcasts. Its goal is to inspire students with the excitement of flight and the possibility of a career in aviation. The five videos explain the forces acting on an airplane in flight, the relationship between potential and kinetic energy of flying objects, and cockpit instrumentation, as well as different navigation types and the impact of weather on aviation. Many of the concepts in the videos and activities are explained with the mathematical formulas that correspond to force and motion. Questions for class discussion are found within the video segments. The web site features a forum for student and teacher discussion about classroom projects, ideas for grade-specific classroom activities, career information, and sections about historic events and people in aviation. An interactive glossary and an index of aviation and education-related resources can also be found on the site. Each chapter in the teacher's guide, which supplements a video as an independent unit, contains background information and student activities. The teacher's guide contains tables that show how the activities are aligned with national standards. The activities are labeled as Thought Experiments, which challenge students to mentally design and implement experiments, or Exploring Further, which are hands-on investigations. (Author/JR) ENC-016513

A World in Motion II: The Design Experience

Grade 7
1996
Author: Dan Dick, Bernie Zubrowski, Doug Haller, Shelley Isaacson, Cindy Char, Jan Ellis, Lorena Martinez, Brian Williams, Myles Gordon and Marilyn Quinsaat

Ordering Information
Society of Automotive Engineers (SAE)
400 Commonwealth Drive
Warrendale, PA 15096
(724) 772-8513 / Fax: (724) 776-0890
Toll-free: (800) 456-2946
www.sae.org

FREE kit
Note: Free with provisions that will be explained when you order. Now also called Challenge 2 & 3 (middle school).

This multidisciplinary curriculum unit is one of three engineering design challenges that take the form of real-world design scenarios. Each challenge focuses student design teams, teachers, and volunteers from the professional community on the math, science, and technology concepts required to solve a design problem over an eight-week period. In this unit, the challenge is posed in a letter from a fictitious toy company, Mobility Toys, Inc. (MTI). MTI is looking for designs for a new line of motorized, gear driven toys. The letter requests written proposals, sketches, and working models of designs that meet a specific set of requirements. In the unit, students complete a variety of activities that help them develop a proposal and a prototype for a toy of their own design. Through hands-on activities, students learn about energy, force and friction, simple machines, levers and gears, and torque; geometric concepts inherent in body design and performance, gear ratios, and the radius of a wheel; data collection and retrieval techniques; and basic statistical analysis. In addition, students practice public speaking and writing skills as they prepare their proposal and presentation for a review panel of teachers and volunteers. The teacher's guide provides background information, time, materials lists, and procedures for each activity; teacher and volunteer tips; guidelines to help visiting engineers and other partners evaluate student work; duplication masters for student worksheets; and assessments. Assessment activities include embedded assessments, open-ended response tests, portfolios, and an activity that asks students to evaluate two Design Log entries. Additional materials include an orientation video, a planning poster, and a classroom design poster. (Author/LCT) ENC-008426

Mathematical Quilts: No Sewing Required!

Grades 7-11
1999
Author: Diana Venters, Elaine Krajenke Ellison

Ordering Information
Key Curriculum Press
1150 65th Street
Emeryville, CA 94608
Fax: (800) 541-2442
Toll-free: (800) 995-6284
Email: orders@keypress.com
www.keypress.com

$14.95 per book (paperback)

This teacher resource book, written by two math teachers who are also quilters, contains activities that aim to help students in grades 7 to 11 improve their visualization skills and discover the underlying mathematical concepts in quilt designs. The authors developed their activities based on the van Hiele model for learning geometry, which defines five levels of learning and visualization through which students must progress in order to succeed in geometry. Activities explore topics ranging from the Pythagorean Theorem to Fibonacci sequences to tesselations. The book is divided into thematic sections, each highlighting a series of quilts with similar designs: Golden Ratio Quilts, Spiral Quilts, Right Triangle Quilts, and Tiling Quilts. In each section, an introduction to the theme discusses the mathematical concepts related to the quilt design; the student activities then guide students through the development of the mathematical concepts. A description of how to actually make the quilt is included for those interested in sewing their own quilt. Each section also includes research activities featuring the use of graphing calculators, computers, or the Internet. Teacher notes, solutions to activities, and a bibliography conclude each section. More than 50 blackline masters are included for the student activities. (Author/JRS) ENC-016040

SimCity 3000

Grade 7 and up
1999
Author: Electronic Arts Inc.

Ordering Information
Electronic Arts
209 Redwood Shores Parkway
Redwood City, CA 94065
(650) 571-7171 / Fax: (650) 628-1392
www.ea.com/

$49.95 per CD-ROM package (Windows)
Note: Contact publisher for system requirements.

This CD-ROM allows students to build and manage their own community and is a realistic simulation of city management and the difficulties associated with it. Students may start from landforms that are randomly generated or they can create their own. They may also choose to start their city from nothing or begin with a preplanned basic town. Once they have their city operating, they must zone residential, commercial, and industrial areas for low, medium, and high density. Consequences result from all choices. Police and fire departments as well as schools and hospitals must be added. Energy is supplied to the city from power sources ranging from coal-fired plants to solar energy sources. Water must be pumped to residents and garbage must be removed. Recycling is an option but like all options in this game there are monetary concerns involved. Students must balance environmental concerns with economic concerns and deal with disasters as they occur. The game provides advisors for factors such as transportation, the environment, and city planning. The simulation is complex and requires students to control many factors. Students who are successful are awarded gifts from their citizens, while unsuccessful mayors may be run out of town. (SSD) ENC-016504

The Mathematics of Architecture: Building by Numbers
Seeing through Mathematics Series

Grade 9 and up
1998
Author: producer, Anne Marie Gallen

Ordering Information
Films for the Humanities & Sciences
PO Box 2053
Princeton, NJ 08543
Fax: (609) 275-3767
Toll-free: (800) 257-5126
www.films.com

$129.00 per video

This videotape illustrates how major architects, from Andrea Palladio in the 16th century to Le Corbusier in the early twentieth century to contemporary architect Bernard Tschumi, applied mathematics in the design of their projects. Through interviews with historians and architects and views of representative buildings, the video describes how Palladio used the geometry of squares and rectangles to achieve harmonious proportions in his structures, such as the Villa Pisani in Italy. It also demonstrates how Le Corbusier used ratios and proportional relationships to explain his design of structures, including the Villa de Roche in France. Tschumi discusses how the incorporation of Chaos Theory into his design of a Paris park helped him represent the disorder of modern life. (Author/JRS) ENC-016498

Money

Money, Grades 1 and 2
Math By All Means Series

Grades 1, 2
1998
Author: Jane Crawford, Math Solutions Publications

Ordering Information
Dale Seymour Publications
4350 Equity Drive
PO Box 2649
Columbus, OH 43216
(800) 237-3142 / Fax: (800) 393-3156
Toll-free: (800) 231-3106
www.pearsonlearning.com

$28.50 per resource book (paperback)

Standards: NCTM Curriculum and Evaluation Standards (1989)

Part of the Math By All Means series, this kit of manipulative materials is designed to accompany a five-week unit on number sense and counting with money. Each unit in the series integrates the primary topic with other strands (in this case, number, geometry, statistics, and measurement). Each unit is comprised of four components: whole class lessons, menu activities, assessments, and homework. An accompanying kit contains a classroom set of manipulatives suggested by the lessons and menu activities for student use and for the overhead projector. Games, activities, and investigations are accessible to those with limited math experience but also have the potential to stimulate and challenge more capable and experienced learners. In addition to manipulative materials such as number cubes, Snap Blocks, magnifying glasses to look at the money, and rubber stamps to make paper coins, the kit contains a resource guide describing activities that have been successfully used to present and develop mathematical concepts at various grade levels. The resource guide also offers activities meant to connect mathematics with children's literature. Menu activities are designed to allow children to work independent of the teacher in groups, pairs, or individually. The activities are designed to pose problems, set up situations, and ask questions that help children interact with the unit topic. The series has been designed in response to current guidelines for instruction as represented by the NCTM *Curriculum and Evaluation Standards for School Mathematics* (1989). (Author/RMK) ENC-012828

Investing for Kids
tqd.advanced.org/3096/

Grade 1 and up
1997
Author: David Leung, Steven Ngai, Hassan Mirza

This web site, designed for kids by three high school students from California, aims to offer everything anyone, including adults, needs to know about investing in the stock market. It answers basic questions such as: How does money grow? and When and Why should I invest? It explains the seven basic types of investments. It contains software for setting up stock portfolios and links to current market readings and information about specific stocks. As an example of its offerings, the Java Financial Goal Calculator section allows the investor to enter five different financial goals with different initial investments amounts, monthly investments, and rates of return. The program calculates and displays time needed to reach the goals and investment gains in dollars for each of the five investment strategies. The use of the Goal Calculator is illustrated with five sample college funding plans to generate $50,000. Other sections of the site include an introductory financial quiz, a glossary of stock terms, and a stock market simulator. Winner, ENC Digital Dozen, April 1998. (Author/JRS) ENC-012044

Money
Intermediate Themeworks Series

Grades 4-6
1997
Author: June Fuji, Avery Walker

Ordering Information
Creative Publications
5623 West 115th Street
Alsip, IL 60803
(708) 385-0110 / Fax: (800) 624-0821
Toll-free: (800) 624-0822
www.creativepublications.com

$28.75 per book

This book, part of the Intermediate Themeworks series, uses hands-on activities and simple text to teach students about money. The series consists of theme-based books that provide learning experiences in science, math, language, social studies, and art. This book helps students explore the history of money, examine various things people have used for making exchanges, study the significance of the designs and symbols that embellish the currency, and read about how the government regulates the flow of money through the economy. Students also discuss various possibilities for managing money wisely, learn about the stock market, examine income tax forms, and play and create board games. The final activity helps students identify their own attitudes about money and make lifestyle choices. The book includes activity sheets, suggestions for culminating activities, and a curriculum chart listing subjects covered in the book and corresponding learning goals, along with a list of fiction and nonfiction books related to the topic. (Author/RA) ENC-010261

Environment

Counting on a Small Planet: Activities for Environmental Mathematics

Grades K-4
1991
Author: Ann and Johnny Baker

Ordering Information
Greenwood Publishing Group, Inc.
88 Post Road West
PO Box 5007
Westport, CT 06881
Fax: (303) 222-1502
Toll-free: (800) 225-5800
www.greenwood.com

$19.00 per book

The goal of this book is to develop children's awareness of the responsibility they each have to look after the environment. Children are encouraged to use math to explain how their individual actions affect the environment and what steps they can take to preserve it. Each topic in the book has an introductory activity that can be used to gauge the children's level of interest. The suggested investigations provide ideas for further action when interest is

high, and the Math Fact Files at the end of each topic relate local concerns to the global situation. In one activity, for example, students brainstorm methods of measuring noise levels then test their ideas. The authors hope that the activities encourage children to first pose their own questions about their environment, then develop mathematical strategies and measurement techniques to answer their questions. (Author/KFR) ENC-005742

Enviromath: Activities to Stimulate Interest, Integration, and Inquiry in Grades K-8

Grades K-8
1997
Author: Bobbie S. Oh; illustrated by Michael Wright
Publisher: Kendall/Hunt Publishing Company

Ordering Information
Two Herons Orders
PO Box 722
Oxford, OH 45056
(513) 523-7223

$17.95 per book (spiral-bound)

This teacher resource book uses a hands-on, inquiry based approach in 25 activities that combine mathematics and environmental science. Skills covered include patterning and classifying, graphing, measuring, computation, and problem solving. Each activity contains background information about the environmental concept(s) emphasized, needed materials (commonly found in the classroom or home), reproducible student pages, and extension ideas. Goals are to interest students by using real-world contexts and to integrate traditionally separate disciplines. In one activity, students learn how to measure the circumference, crown width, and height of a tree. They explore the diversity and scale of trees in their school's neighborhood and, using measuring techniques described in the book, locate the champion tree. In a related extension activity, students calculate the age of the champion tree and learn about the historic events the tree has lived through. References are included for each activity. (Author/JRS) ENC-016378

Trash Plans: Using Math to Help Us Make Decisions About Our Environmènt

Scholastic Math Place: Real World Math for Thinking Kids.

Grade 2
1995
Author: Scholastic Inc.

Ordering Information
Scholastic, Inc.
PO Box 7502
2931 E McCarty Street
Jefferson City, MO 65101
Fax: (573) 635-5881
Toll-free: (800) 724-6527
Email: CustServ@scholastic.com
www.scholastic.com/

$350.00 per kit
$875.00 per grade level set
Note: Set includes all components for the six units except Little books of exploration, Little trade books, and manipulatives. Contact publisher for additional ordering options.

Math Place consists of a set of kits developed by Scholastic and leading mathematics educators for grade levels K to 2. This unit, one of six developed for grade 2, is designed to teach the concepts of planning, modeling, and reasoning to optimize decision making. Activities include estimating area and volume to manage space; adding, subtracting, and exploring larger numbers to help plan; and making maps and schedules to organize activities. A video illustrates that paper, plastic, glass, and aluminum products that are not recycled create large amounts of garbage and deplete our natural resources. Also included are two audiocassettes: one narrates a story in a big book about actual representation of objects and counting powers of ten such as one billion, and the other provides an overview of materials needed, lesson strategies, and assessment suggestions. The kit also includes various MathMats: PlaceMats (to record investigations of questions and problems), ThinkMats (to provide additional opportunities to develop higher level thinking skills), and SkillMats (to provide children with additional experiences in measure concepts and operations). Also included are a list of resources, a math assessment collection, and home connection materials such as letters (provided in multiple languages) to explain the mathematical concepts being studied and related family activities. Blackline masters include worksheets and open-ended questions for assessment. Titles of the other second grade kits are Numbers, Numbers; Math Museum; A World to Measure; Data News; and Numbers in the Wild. (Author/LDR) ENC-006407

EnviroNet Monitoring Projects

earth.simmons.edu/monitoring_projects/index.html

Grades 5-12
1996
Publisher: Department of Biology, Simmons College

EnviroNet is a network of teachers, scientists, environmental educators, and others who use telecommunications to enhance environmental science education. The web site provides timetables and short descriptions for each project, along with detailed procedures for data collection and contact information. Entry Level participants perform simple experiments and send their raw data to the project coordinator over the Internet; Exploratory Level participants perform slightly more advanced experiments and do simple data analysis with an online spreadsheet. After completing the first two levels, students can participate on the Research Level, where they design their own experiments, analyze the data, and send it to the project coordinator. Ongoing projects include Acid Rain, in which participants monitor pH levels in all forms of precipitation, and a Bird Watch project, in which data is collected on bird populations at feeders and nest boxes. The Plant project helps students understand the biological diversity of the plant kingdom and how people of various cultures use plants, and the RoadKill program is designed to show the diversity of animals that are killed on highways and to bring about awareness of fragmented wildlife corridors in the participants' own communities. Other options include the Ozone project, the Vernal Pool project, and the WhaleNet project. Background information and templates for activity sheets are provided. Winner, ENC Digital Dozen, March 1996. (Author/LCT) ENC-004122

Trash Conflicts: A Science and Social Studies Curriculum on the Ethics of Disposal, An Interdisciplinary Curriculum

Grades 6-8
1993
Author: Amy Ballin with Jeffrey Benson and Lucile Burt

Ordering Information
Educators for Social Responsibility
23 Garden Street
Cambridge, MA 02138
(617) 492-1764 / Fax: (617) 864-5164
Toll-free: (800) 370-2515
Email: educators@esrnational.org

$28.00 per book (paperback)

This guide is designed to promote students' understanding of the impact of waste production and disposal and to increase students' feelings of empowerment for the changes they can effect. The book provides a curriculum integrating science, social studies, math, and language arts and is divided into sections to help students develop their ideas regarding trash, hazardous waste, environmental safety, and social justice. Each activity contains objectives, the time required, materials, and procedures. Teachers can find notes related to the special concerns or requirements of the activity as well as background information relating to the activity's focus. Embedded assessments and evaluations are outlined. In one activity called Burning Cans students learn the effects of incineration on the volume and weight of trash, as well as the production of emissions and ash. Students simulate a trash-burning, calculating the size and weight of the waste before and after burning, and then discuss what components of the trash are gone, the risks and benefits of incineration as a means of waste disposal, and how their incinerator compares to a real one. A glossary and lists of additional resources and Environmental Protection Agency (EPA) regional contacts are included. (Author/JSR) ENC-014278

Leaf Pack Experiments Stream Ecology Kit

Grades 8-12
1999
Author: Ann M. Faulds, Claire Murray, Kathy Neville, Al Palmer, Alan Saxton, Samantha Mason & Kristen Travers, Academy of Natural Sciences of Philadelphia, Stroud Water Research Center

Ordering Information
LaMotte Company
PO Box 329
Chestertown, MD 21620
(410) 778-3100 / Fax: (410) 778-6394
Toll-free: (800) 344-3100
Email: LaMotteESE@aol.com
www.lamotte.com

$159.00 per kit

This kit contains the information and equipment necessary for students to design, implement, and analyze their own aquatic ecology experiments using artificial leaf packs. The activities involve the experimental introduction of leaves into streams, so that the leaves become colonized by macroinvertebrates. The goal is to help students gain an understanding of the structure and function of stream communities. Experiments are designed to be adaptable to various grade levels, time constraints, and numbers of students. The kit contains mesh bags with a label sewn on one end. The leaves that are collected for the experiment are weighed (using the included scale) and placed in the mesh bags. The students label the bags, then tie them shut, and attach them to a rock with nylon twine, and put them in a stream. The students record the abiotic and biotic characteristics of their experimental sites. After they have retrieved the bags, the students find and identify the organisms using illustrated sorting sheets and plasticized macroinvertebrate identification flashcards, which have color photographs of the organisms on one side and key characteristics with line drawings on the other. The materials in the kit are designed to be reusable. An instructor's manual provides background information, experiment suggestions, and discussion questions. Reproducible data sheets, a glossary, and a resource list are also included. (Author/JR) ENC-015954

Biodiversity

Global Environmental Change Series

Grades 9-12
1997
Author: Irwin Slesnick, Brad Williamson, Linda Wygoda, Margaret Edwards, and Sara Krauskopf

Ordering Information
National Science Teachers Association (NSTA)
PO Box 90214
Washington, DC 20090
(703) 243-7100 / Fax: (703) 522-6091
Toll-free: (800) 722-6782
Email: science.scope@nsta.org
www.nsta.org

$11.66 per book (paperback)
ISBN: 0-87355-157-5
Note: NSTA member price;
$12.95 non-member price

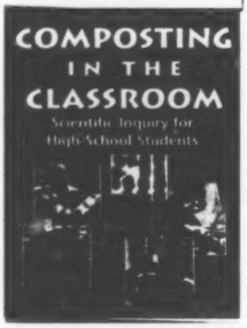
This book is the first installment in the Global Environmental Change series. The series uses case studies to focus on global environmental topics and links ecology and biology with insights and information from other disciplines including economics and other social sciences. The series teaches students how to gather a wide range of data and information to develop their own opinions to make decisions and solve problems. The many hands-on activities in the book use Costa Rica as a case study to show how one country went about protecting and conserving its natural resources while enhancing economic growth. Each of the five activities contains background information, ideas and demonstrations to stimulate introductory discussion, and procedures and possible variations as well as summary discussion questions, suggestions for further study, and reproducible student worksheets. The activities begin by introducing students to the concept of biodiversity by examining the organisms found in weathered conifer cones, move on to examining life zones, extinction, and taxonomy, and quantifying the biodiversity of a grassy area. The final activity asks students to role-play the juggling of social, political, economic, ecological, and personal problems found in the preservation of a tropical forest. Many resources for the teacher are provided at the end of the book including web sites, books, and organizations. (Author/SSD) ENC-015269

Composting in the Classroom: Scientific Inquiry for High School Students

Grades 9-12
1998
Author: Nancy M. Trautmann, Marianne E. Krasny

Ordering Information
Kendall/Hunt Publishing Company
4050 Westmark Drive
PO Box 1840
Dubuque, IA 52004
Fax: (800) 772-9165
Toll-free: (800) 770-3544
www.kendallhunt.com

$30.95 per book (paperback)



This book is a guide for directing composting research projects involving chemistry, physics, and biology. The book begins with an overview of composting science and provides instructions on how to build and add the right mix of ingredients to compost systems. The monitoring of the composting process is outlined along with the procedures for measuring the attributes of the finished compost. Tips for conducting research and ideas for research projects are found throughout the book. There are many unknown factors in the composting process that allow students to carry out original research in this area. Suggestions for projects allow short-term and long-term commitments, simple and inexpensive materials, and easy to complex experimental systems. Students are encouraged to develop their own projects, and many ideas for science fair projects can be found in the text. Chemistry activities include monitoring pH and heat changes as well as examining the decomposition of organic compounds. The physics of heat transfer can be studied and microorganisms can be cultured. A glossary of terms is found at the back of the book along with a list of resources for in-depth information on aspects of composting. (Author/SSD) ENC-015158

The Digital Field Trip to the Rainforest

Digital Field Trip Series

Grades 9-12
1998
Author: Digital Frog International

Ordering Information
Digital Frog International
Trillium Place
7377 Calfass Road RR #2
Puslinch, ON N0B2J0
(519) 766-1097 / Fax: (519) 767-9994
Email: info@digitalfrog.com
www.digitalfrog.com

$99.00 per CD-ROM package
(Mac/Windows; educational version)

This CD-ROM with its accompanying teacher's guide, study guide, and booklet about Belize can be used as preparation or follow-up for a real field trip, in lieu of a field trip, or as a teaching aid for forest ecology and biology. The program virtually transports the users to Blue Creek Rainforest Reserve in Belize, but the principles explored can be applied in the study of forests around the world. The students can choose to study topics such as rainforest types or ecological relationships in a community superficially or comprehensively. If the user decides to visit one of the twenty eight stops on the virtual field trip, the screen is divided into three sections—one with a map of the trip, one in which the user can move around and view each site in all directions, and one with text that describes the site. The study guide contains questions to be explored in the virtual field trip. It includes additional questions that connect the ideas in the program to the real world and hands-on activities. One such activity asks the students to test the effect of light intensity on plants. The teacher's guide has the same format as the study guide, along with answers to the questions and teaching tips. A table references the topics on the CD and the study guide. Links to World Wide Web sites and other references are offered. The booklet about Belize contains full color pictures of the animals, accommodations, and people of that area. (Author/JR) ENC-015636

Environmental Science: Field Laboratory

Grades 9-12
1997
Author: Dwight Bishop, John Hirschbuhl, Jim Jackson

Ordering Information
Falcon Software, Inc.
One Hollis Street
Wellesley, MA 02181
(781) 235-1767 / Fax: (781) 235-7026
Email: FalconInfo@FalconSoftware.com
www.falconsoftware.com

$395.00 per CD-ROM package (Windows)
Note: Contact publisher for system requirements.

This CD-ROM uses simulated field studies to help students learn about seven different environmental issues. Each simulation features simple graphics and text that describe background information as well as real-world investigation and evaluation techniques. Students role-play to learn about research equipment and techniques, gather and record simulated data, then draw conclusions and make decisions based on these data. The studies may also involve simple calculations that a real investigator would typically perform. Some of the studies are based on actual environmental issues, including one that looks at radioactivity around a nuclear power plant and another that analyzes land use around the Cuyahoga River flood plain. Other studies consider land development issues, mineral deposit analysis, and the role of the EPA in pollution control. The program evaluates the student's study and recommends ways to improve the data or the student's conclusions. The scientific method is emphasized, and the simulations also encourage students to consider social and economic factors. Each module concludes with a simple multiple-choice test and a thought-provoking essay question. Students' responses can be saved to disk for review by the instructor. A full glossary and online help are available with each module. The package includes a user's manual with test answers. (RJD) ENC-015672

Field Manual for Water Quality Monitoring: An Environmental Education Program for Schools

GREEN (Global Rivers Environmental Education Network) Series

Grade 9 and up
1997
Author: Mark K. Mitchell, William B. Stapp

Ordering Information
Kendall/Hunt Publishing Company
4050 Westmark Drive
PO Box 1840
Dubuque, IA 52004
Fax: (800) 772-9165
Toll-free: (800) 770-3544
www.kendallhunt.com

$21.95 per field manual (paperback)

This manual, part of the Global Rivers Environmental Education Network (GREEN) series, is designed to help students identify community water quality issues and devise solutions to improve the health of their environment. GREEN is a hands-on, action oriented approach to education based on an interdisciplinary watershed educational model. Its mission is to improve education through a global network that promotes watershed sustainability. This book explains what a watershed is and describes techniques to measure water quality. It suggests measuring both abiotic and biotic indicators of water quality. Black and white photographs and line drawings illustrate the equipment needed to assess the water. One chapter, which describes the use of benthic invertebrates as indicators, contains pictures of kick nets and Serber samplers, drawings of aquatic insects that might be captured, and formulas to calculate diversity indices that reflect water quality. Ways that land use can affect water quality are discussed. Examples of rivers that have been studied, both in the United States and internationally, are described in terms of how they can be used in interdisciplinary lessons. Appendices contain handouts, data sheets, and surveys as well as information for the acquisition of testing equipment. (Author/JSR) ENC-014501

Task Force Environmental Investigation Kit

CyberLearning Collection Series

Grade 10 and up
1997
Author: Ron S. Nolan, Susan A. Nolan

Ordering Information
Digital Studios
209 Santa Clara Avenue
Aptos, CA 95003
(831) 688-3158 / Fax: (831) 688-5738
Toll-free: (800) 499-3322
Email: nolan@cyberlearn.com
www.cyberlearn.com

$149.95 per kit (Mac/Windows)
Note: Lab pack available; contact publisher for information and system requirements.

This kit provides information and lesson plans related to the decline of salmon populations in the Pacific northwest. The kit, which includes a videotape, two CD-ROMs, a teacher's guide, and a web site, exposes students to the controversies surrounding this issue. The material has been divided into four major units of study: natural history, hatcheries and harvest, the hydrosystem, and management plan. To begin the investigations, students and teachers view the videotape, which provides an overview of the issue and explains how the users can navigate through the program on the CD-ROMs. The CDs include scientific reports and personal perspectives presented in text and video clips; real data are displayed on tables, graphs, and maps. On the web site, students and teachers can post opinions, access new reports and editorials, and go to related links. At the site they can also access worksheets and discussion questions related to the investigations in the kit. The teacher's guide offers procedures for an inquiry-based learning project so that students can develop their own management plan for the salmon. In one investigation, students view movies, read reports, and analyze data to address questions related to the cultural, economic, and ecological value of the salmon for Native Americans. Worksheet masters are included. (Author/JSR) ENC-014254

Seals, Fish and You: The Nature of the Story

Grade 11 and up
1994
Author: Susan D. Wallace, Dean Huyck

Ordering Information
International Marine Mammal Association, Inc. (IMMA)
1474 Gordon Street
Guelph, N1L 1C8
(519) 767-1948 / Fax: (519) 767-0284
Email: ccosgrove@imma.org
www.imma.org

FREE kit
Note: Each kit includes one teacher's guide, independent study unit, videotape, and audiotape). Email swallace@imma.org for an order blank.

This kit introduces students to concepts about ecological issues in the Atlantic Canadian fisheries and conflicting ideas about the management of the seal and fish populations. The kit presents background information on a videotape and an audiotape, as well as in 91 resource documents including newspaper articles, verbatim reports of Canadian House of Commons proceedings, and interest group letters. Cartoons about the controversy in the fishery are found throughout the teacher's guide. Students are cautioned to pay attention to the sources of the materials and to question what they read as they familiarize themselves with all sides of the argument. One activity takes the form of a public hearing about the issues related to increased hunting or culling of seals. The students in the class are divided into groups and try to persuade the members of the other groups to accept their positions. The study unit contains background information about each group, the sequence of events in the hearing, strategy worksheets, possible character roles, and a list of resources related to each group's position. The unit is written to correspond to the Ontario Ministry of Education Curriculum Guidelines. The teachers' guide offers suggestions for shortening the study unit, student evaluation, and possible extensions. (Author/JR) ENC-016734

Life Sciences

What Tree Is It?

www.oplin.lib.oh.us/products/tree

Grades K-12
1997
Author: Ohio Public Library Information Network and the Ohio Historical Society

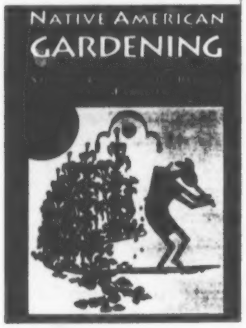
This web site serves as a field guide to more than 50 trees common to the Ohio region. It was designed to help students identify trees when they have leaf or fruit samples. Information pages provide instruction on fruit and leaf structures and terminology. As students work through the site, they click on the image that best resembles their sample. Each page has multiple views of possible choices with accompanying text. When students have narrowed their choices down to one tree, it is possible to click on the image and also the highlighted name to go to the fact page for that tree. Fact pages contain close-up photographs of seeds, fruits, bark, leaves, or other plant parts useful in identifying the tree as well as a picture of the full tree and information about its habitat, history, and structure. (Author/SSD) ENC-016423

Native American Gardening: Stories, Projects, and Recipes for Families

Grades 1-12
1996
Author: Michael J. Caduto and Joseph Bruchac

Ordering Information
Fulcrum Publishing
350 Indiana Street, Suite 350
Golden, CO 80401
(303) 277-1623 / Fax: (800) 726-7112
Toll-free: (800) 992-2906
Email: fulcrum@fulcrum-books.com

$15.95 per book (paperback)



This book uses gardening as a springboard for families to study plants, the environment, and Native American cultures. It integrates garden-centered activities with Native American stories. The related activities use materials that are commonly available outdoors or at home. Garden products are used in the activities to make gourd birdhouses, corn husk dolls, and vegetable recipes. Scientific concepts, such as biodiversity, plant life cycles, and nitrogen fixation, are embedded in the activities. One sample activity gives the participants the opportunity to learn about seeds from Native North American crops. A Tutelo story, called The Bean Woman, introduces the chapter containing this activity. Addresses are provided for suppliers of heirloom seeds. Readers can find diagrams for different garden planting patterns. Black and white photographs and line drawings are found throughout the book. A glossary and pronunciation key to Native American terms is included. (Author/JR) ENC-016318

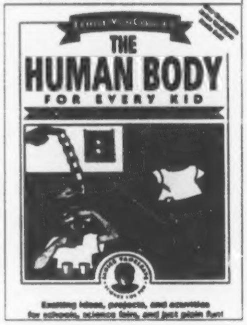
The Human Body for Every Kid: Easy Activities That Make Learning Science Fun

Science for Every Kid Series

Grades 3-8
1995
Author: Janice VanCleave

Ordering Information
John Wiley and Sons, Inc
One Wiley Drive
Somerset, NJ 08875
(908) 469-4400 / Fax: (732) 302-2375
Toll-free: (800) 225-5945
www.wiley.com

$12.95 per book (paperback) ISBN: 0-471-02408-2


THE
HUMAN BODY
FOR EVERY KID
Exciting ideas, projects, and activities for schools, science fairs, and just plain fun!

This hands-on activity book teaches concepts about the human body while developing the students' problem solving strategies. The series covers a wide range of topics including biology, chemistry, and math. This book addresses topics in physiology, such as the nervous, digestive, and circulatory systems. The information in this book is cumulative, so the author suggests that the activities be completed in order. Each section provides definitions and an explanation of background information, exercises in which students interpret diagrams using the facts they have just learned, and a project related to the facts. Readers can find an explanation of the thought process required to solve the exercises. One section discusses the composition, growth, and color of hair and nails. Students identify on diagrams which parts of the body are not covered with hair and where on a fingernail the luna is located. The activity for this section investigates whether straight or curly hairy is stronger. (Author/RA/JR) ENC-016405

Magnificent Microworld Adventures: Microscopic Topics

AIMS Activities

Grades 4-9
1996
Author: Mike Wood; editors, Jim Wilson, Betty Cordel, Judith Hillen

Ordering Information
AIMS Education Foundation
PO Box 8120
Fresno, CA 93747
(559) 255-4094 / Fax: (559) 255-6396
Toll-free: (888) 733-2467

$16.95 per activity book (paperback)
$24.95 per video

Standards: Benchmarks for Science Literacy (1993)

This book and videotape introduce students to microscopy skills and microscopic organisms. The hands-on activities in the book stimulate students' curiosities about the microscopic world. The series integrates mathematics and science with other curriculum areas including language arts, social studies, physical education, art, and music. The book contains activities and background information covering the varieties, maintenance, and use of microscopes. Students make observations and measurements using the different types of microscopes and learn how to keep accurate records of their observations. They participate in activities that use protozoa and easily observed plant and animal cells. Each activity lists the key questions, corresponding standards, and integrated disciplines as well as procedures and materials. Some sections of the book have video clips, two to seven minutes in length, that help teachers understand how to set up and manage topics discussed in the book. A reference section contains video clips of both living and nonliving objects that give teachers and students a realistic view of what they should see under their microscopes at twenty power. Reproducible handouts are found throughout the book. (Author/JR) ENC-016131

Nervous System
Human Biology Series

Grades 6-8
1999
Author: H. Craig Heller, Mary L. Kiely, Stan Ogren

Ordering Information
Everyday Learning Corporation
PO Box 812960
Chicago IL 60681
(312) 540-0210 / Fax: (312) 540-5848
Toll-free: (800) 382-7670
www.everydaylearning.com

$25.00 per teacher's guide (paperback)
$8.50 per student text (paperback)
Note: Contact vendor for quantity discounts.
$212.50 per classroom set
Note: Includes 25 single-title student texts and 1 teacher's guide.

These books introduce the human nervous system's structure and function as well as its relationship to the world around us. The goal of this interdisciplinary activity-based program, developed by the Human Biology Life Sciences Curriculum Project at Stanford University, is to engage middle school students in science activities that encourage careful decision making in their own lives. In this unit students study how the brain functions as a control center for coordinating essential body processes and responding to sensory feedback. It encourages students to use this information to make good personal choices to protect and make the most of their nervous system function. The teacher's guide contains an overview of the lessons, suggestions for methods, assessments to use or adapt, and activity guides. Interdisciplinary connections, enrichment activities, and reproducible student activity pages are provided. The student book contains background information, directions for the activities, and questions to help students review, evaluate, and apply the chapter concepts. Students learn that the brain is the most complex matter in the universe, consider how the human brain capacity is different from other animals, and study how electricity is involved in nervous system functions. The students are shown how the neuron works as the functional unit of the nervous system and how the environment can affect that system. A glossary is included in both books. Also available from this series is Breathing, which introduces the mechanisms of the respiratory system and the factors that influence its efficiency. In this unit students explore links between nature and their own breathing system to solve problems and answer questions such as: What is an Adam's apple? and What do first- and second-hand smoke do to the lungs? (Author/JR) ENC-016031 & ENC-016085

Promises & Perils of Biotechnology: Genetic Testing
Winding Your Way Through DNA Series

Grade 10 and up
1996
Author: project director and executive producer, Valli T. McDougle

Ordering Information
Cold Spring Harbor Laboratory Press
Fulfillment Department
10 Skyline Drive
Plainview, NY 11803
(516) 349-1930 / Fax: (516) 349-1946
Toll-free: (800) 843-4388
Email: cshpress@cshl.org
www.cshl.org

$70.00 per video and teacher's guide

This video and teacher's guide, designed for high school and college biology classes as well as public education programs, provides insight into the personal, professional, and ethical issues in human genetics and genetic testing. The video highlights two cases, one involving Huntington's disease and the other, familial hypercholesterolemia. Viewers can hear the conflicting factors related to the decision of whether to find out if a person is a carrier of an incurable genetic disorder. The processes involved in genetic testing such as electrophoresis and polymerase chain reaction (PCR) are discussed. Geneticists are seen analyzing DNA in the lab, conferring with patients, and educating the public about genetic disorders. The goals of the Human Genome Project are outlined, and the issue of genetic discrimination is explored. The teacher's guide contains questions to be answered before and after viewing the video. Seven activities are included to help students understand the biological and personal aspects of genetics disorders. In one activity, students role-play to explore the dilemmas of testing for late onset disorders. Handouts, related resources, and a glossary are included in the guide. (Author/JSR) ENC-014556

Earth/Space Science

Watching the Weather
What Is Weather? Series

Grades K-2
1999
Author: Miranda Ashwell and Andy Owen

Ordering Information
Heinemann Library
PO Box 1650
Crystal Lake, IL 60039
Fax: (888) 844-5329
Toll-free: (888) 454-2279
Email: Heinemanninfo@HIL.com

$19.92 per book (library binding)
Note: School/Library discount price: **$13.95**

This book presents topics related to watching the weather, including the need for weather prediction, how certain types of weather are measured, and how weather patterns are observed. Each book in the series explores a weather condition and how and when it happens, as well as how people, plants, and animals live through different kinds of weather. It also explains why it is important to watch the weather, who does it, and how. This book explores such topics as what a red sky at night means, what a rain gauge is, and what weather balloons do. Throughout the book, students are also introduced to explanations for the weather facts behind weather stories and how things that happen on Earth can change the weather. The book is illustrated with large, full color photographs that depict examples from around the world to show different countries and climates, and satellite photos of storms. A glossary, a list of suggested readings, and an index are included. Also available from this series is Wind, which presents the causes and effects of wind, such as what a hurricane is, where the windiest place in the world is, and how lions use wind to hunt. (Author/YK) ENC-015885 & ENC-015886

Primarily Earth
AIMS activities

Grades K-3
1996
Author: Evalyn Hoover, Sheryl Mercier

Ordering Information
AIMS Education Foundation Orders
PO Box 8120
Fresno, CA 93747
(559) 255-4094
Fax: (559) 255-6396
Toll-free: (888) 733-2467

$16.95 per activity book (paperback)

Standards: Benchmarks for Science Literacy (1993); National Science Education Standards (December 1995); NCTM Curriculum and Evaluation Standards (1989)

This book contains hands-on activities that encourage students to use their senses to make observations leading to a better understanding and appreciation of the world around them. The series integrates mathematics and science with other curriculum areas including language arts, social studies, physical education, art, and music. Twenty-three activities are categorized into sections dealing with the geosphere, hydrosphere, and the atmosphere. Each section provides background information to help explain that portion of the biosphere. Each activity lists the key questions, corresponding standards, and integrated disciplines as well as the procedures and materials. One activity in the geosphere section asks students to observe soil samples to help them see that soil is made from small bits of rock and things that were once living. The teachers are given background information about the composition of soil and classroom management tips. Students record observations in booklets made from reproducible handouts in the book. As an extension, students see what happens when rocks are placed in a can and vigorously shaken. They compare their experimental results to what happens to rocks exposed to wind and water. Tables elaborate how the Project 2061 *Benchmarks for Science Literacy, National Science Education Standards,* and National Council of Teachers of Mathematics (NCTM) *Standards* are met. Reproducible handouts are found throughout the book. A bibliography is included. (Author/JR) ENC-015921

Water

Full Option Science System (FOSS)

Grades 3, 4
1993
Publisher: Lawrence Hall of Science, University of California with Encyclopaedia Britannica Educational Corporation and Delta Education Inc.
Author: scripted by Sue Jagoda; developed by Lawrence Hall of Science

Ordering Information
Delta Education, Inc.
PO Box 3000
Nashua, NH 03061
Fax: (800) 282-9560
Toll-free: (800) 442-5444
www.delta-ed.com

$469.00 per complete module (includes kit, video, and guide)
$51.00 per teacher preparation video and guide

FOSS is an activity-based elementary curriculum designed to provide students with science experiences that are appropriate to their cognitive stages of development. The series consists of instructional modules organized under four topic headings: Life Science, Physical Science, Earth Science, and Scientific Reasoning and Technology. This Earth Science module comprises four activities in which students investigate surface tension and density, freezing and expanding, evaporation and condensation, and water quality and the water cycle. The videotape provides an overview of the equipment and preparation required for each activity, then takes viewers into the classroom to see students at work with the materials. Students become familiar with the properties of water, discovering ways to alter surface tension and exploring factors that change the rate of flow down an inclined plane. Students observe what happens to water as it is heated, cooled, and frozen and investigate the phenomena of evaporation and condensation. They also test water samples using their senses and chemical indicators and simulate the natural interaction between rainwater and two earth materials, gravel and limestone. The teacher's guide contains an overview of the module, a set of activity folios, and duplication masters for the student sheets as well as a reference list of additional readings and videos. Each activity folio provides an overview of the activity, a list of science concepts covered, background information for the teacher, materials lists, advance preparation notes, and step-by-step procedure. The procedure is also summarized on learning center cards designed to help parent volunteers work with the students. An equipment kit is also available. (Author/LCT) ENC-015805

Hidden in Rocks

Science Seekers Series

Grades 5-8
2000
Author: Tom Snyder Productions and the American Museum of Natural History

Ordering Information
Tom Snyder Productions, Inc.
80 Coolidge Hill Rd
Watertown, MA 02172
Fax: (617) 926-6222
Toll-free: (800) 304-1254
www.teachtsp.com

$79.95 per CD-ROM (Mac/Windows) with teacher's guide and poster
Note: Contact vendor for quantity discounts, site license for multiple CDs, and hands-on optional science kits.

This CD-ROM package features an interactive and game-oriented format, in which students search for potential fossil sites in a remote area of the world called Vastland. Science Seekers is a series of CD-ROM packages that combines multimedia, cooperative learning, and hands-on activities to engage students in core science content. In each Science Seekers title, students role-play a team of science problem solvers on a special assignment. Through an introductory video, students receive a message from the Center for Science Seekers that sets up a problem they need to solve. Students then work away from the computer in cooperative teams, using information sheets and hands-on activities to complete a series of questions. This CD-ROM package includes a CD-ROM, Satellite Imagery Posters, and a Teacher's Guide with a complete set of reproducible student investigation sheets, Science Labs, and Satellite Analysis Log, where students can make notes and guesses about the sites. This CD-ROM consists of five steps of students' investigations, during which students research information to help them achieve their mission. Each investigation takes about one class period to complete. In addition, there is at least one science lab associated with each investigation. All that students have to work with are satellite images of six possible fossil sites in Vastland. To pick the best fossil-hunting site, students must learn all they can about landforms, rock types, plate tectonics and erosion, and also discover they can use the satellite imagery to help them solve their problem. Throughout the first four steps, students learn about related topics through text, video clips, and lab activities in order to continue their investigations and ultimately choose the best location to find fossils. A video reveals whether they have chosen the correct site. In the final step, students hear how a team of paleontologists from the American Museum of Natural History is actually using satellite imagery to hunt for fossil sites in the Gobi Desert in Mongolia. (Author/YK) ENC-016702

Solar System

Interfact Series: The Book and Disk That Work Together

Grades 5-8
1997
Publisher: World Book, Inc. and Two-Can Publishing Ltd.
Author: Two-Can Publishing Ltd.

Ordering Information
Pitsco LegoDacta
PO Box 1707
Pittsburg, KS 66762
Fax: (888) 534-6784
Toll-free: (800) 362-4308
www.pitsco-legodacta.com/

$14.95 per kit (Windows/Macintosh CD-ROM and text)
Note: Contact publisher for system requirements.

This CD-ROM and accompanying text provide information about the solar system through an illustrated book and interactive, multimedia activities. Students can read about the solar system and apply the readings to games, puzzles, and experiments on the CD-ROM. The book features detailed facts, colorful photographs, and historical background of solar system exploration, as well as a glossary and an index. The book is structured in twelve sections in which students discover the planets and their relationship to the Sun, learn how the Sun provides us with the energy we need, and discover the unusual features of the planets. The main menu of the CD-ROM features seven sections including Rocket Mission, featuring a fact finding mission; Here Comes the Comet, where students examine why comets burn and what people have thought of them in the past; and Shuttle Secrets, in which students explore an interactive space shuttle to discover how its parts work. The Time Line shows how our understanding of the universe has changed throughout history; Out of This World features some cosmic questions; and Lost in Space features a quiz on the solar system. Meteor Madness is a quiz in which students can save Earth from a storm of meteorites by answering the questions correctly. (Author/YK) ENC-016708

The Topsoil Tour: The Hands-On Test Kit & Mini Curriculum for Exploring Soil

Grades 5-8
1993
Author: LaMotte Company

Ordering Information
LaMotte Company
PO Box 329
Chestertown, MD 21620
(410) 778-3100 / Fax: (410) 778-6394
Toll-free: (800) 344-3100
Email: LaMotteESE@aol.com

$53.00 per kit

This soil test kit introduces the underlying scientific principles of soil science while stimulating curiosity and enthusiasm by involving students in hands-on investigation of their own soil samples. The kit includes background information for teachers and the same chemical tablets soil scientists use to test pH, nitrate, potassium, and phosphorus. The activities for each test include a materials check list, procedure, data sheets, and a word scramble or crossword puzzle. Reproducible masters of worksheets are also provided. (KSR) ENC-002734

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Oceans Climate Explorer

EarthStation Library Courseware

Grades 5-10
1999
Author: EOA Scientific Systems, Inc.

Ordering Information
EOA Scientific Systems, Inc.
181 Herring Cove Road, Suite 200
Halifax, B3P 1K9
(902) 477-6336 / Fax: (902) 477-6834
Toll-free: (888) 666-6362
Email: sales@eoascientific.com
www.eoascientific.com/eoa.html

$99.00 per CD-ROM package (Mac/Windows)

This CD-ROM presents the scientific fundamentals of modern oceanography, covering topics of the physical, chemical, and biological characteristics and dynamics of the water planet. Each CD-ROM in this series features lessons using interactive multimedia such as satellite images, digital video, and original animations on different aspects of earth science. The CD-ROM aims to give students an understanding of the key processes that occur in the marine environment. The main menu includes four options: Topics of the Lessons, presenting scientific information and theories; Movies, featuring movies and animations to enhance conceptualization of main lesson topics; Interactive Exercises and Projects, featuring hands-on activities; and Advanced Topics Appendices, designed for in-depth research on such topics as chemical properties of seawater, types of waves, and the ozone hole. Each main lesson provides ten to 20 screens, and each screen contains text along with a photograph, diagram, and animation, as well as an interactive exercise. Topics covered in the lessons include Structure of the Oceans, Ocean Heating and Circulation, and Waves and Tides. Throughout the lessons, students learn about how the ocean is composed of different layers, how sunlight causes the oceans to circulate, and how remote sensing by orbiting satellites helps oceanographers chart the oceans. Students also explore what causes waves, tidal waves and tides; investigate what makes seawater such a special substance, capable of sustaining the great diversity of oceanic life; and examine how Earth's atmosphere circulates. Also available from this series is Astronomy Explorer, which presents what we know about the origin, evolution, and structures of stars. The CD-ROM features sections on how to learn about the universe, showing how scientists have learned about stars, planets, moons, and meteorites. (Author/YK) ENC-016510 & ENC-016538

Changing Shorelines

FACETS Series

Grade 6
1996
Author: developed as a project of the American Chemical Society (ACS)

Ordering Information
Kendall/Hunt Publishing Company
4050 Westmark Drive
PO Box 1840
Dubuque, IA 52004
Fax: (800) 772-9165
Toll-free: (800) 770-3544
www.kendallhunt.com

$9.99 per student book
$15.99 per teacher edition

The Foundations and Challenges to Encourage Technology-based Science (FACETS) series of activity books for middle school students, designed by the American Chemical Society, provides hands-on learning in science that involves cooperative group inquiry and critical thinking skills. In this module designed for grade 6, students investigate what happens where land and water meet on sandy shorelines. Throughout the course of the module, students model and investigate barrier islands; explore the effects of waves and wind on particle erosion; and use laboratory work as well as library research to build a case either for or against recreational development on barrier islands. A teacher's guide and a student activity book are provided for each module. The teacher's guide describes the objective and the time line for each activity, provides teachers with background information, materials needed, and illustrations and guidelines on how to run each activity. The student book consists of several activities with background information, procedure, and questions for discussion. Also available from this series is Food Substitutes, a module for grade 6 in which students investigate some of the effects of choosing to eat and cook with food substitutes rather than their real counterparts. (Author/RA) ENC-004953 & ENC-004948

Water, Water Everywhere

Grades 7-12
1991
Author: Cliff Jacobson

Ordering Information
HACH Orders
5600 Lindbergh Drive
PO Box 608
Loveland, CO 80539
(970) 669-3050 / Fax: (970) 669-2932
Toll-free: (800) 227-4224
Email: csays@hach.com
www.hach.com

$24.95 per teaching package (spiral-bound, softcover)
Note: Consists of 1 teacher's guide, 1 student unit, 1 reference unit. Contact vendor for information on quantity discounts and ordering individual texts.

This curriculum kit features a range of hands-on experiments using simple test kits and integrates reading, discussion, and hands-on activities that can be conducted in the classroom or in the field. It focuses on issues affecting water quality such as pH and acid rain, groundwater contamination, wastewater treatment and drinking water quality. This kit includes a Student Reading Unit, featuring new vocabulary explanations; Water Quality Factors Reference Unit, describing chemical, biological, and physical attributes of water; and a teacher's guide that contains a selection of nine simple experiments, a guide to field testing a local waterway, and supplementary activities. The teacher's guide also offers guidelines for reporting field test results to the class, directions for writing the lab report, reproducible students' worksheets, and exams and answer keys. Sample topics covered include measuring dissolved oxygen, thermal pollution, and Coliform bacteria in water. Each activity includes a statement of purpose, focus questions, and background information, as well as a list of materials, step by step procedures, and data sheets. Sample exams in the teacher's guide include Student Reading Unit questions, multiple choice vocabulary tests, and Parent Graded Take Home tests. (Author/YK) ENC-016695

Stars and Stories

Bigger World Series

Grade 7 and up
1997
Author: Lawrence B. Bangs; Wildridge Software, Inc.

Ordering Information
Wildridge Software Inc.
Wildridge Farm Road
PO Box 61
Newark, VT 05871
Fax: (802) 467-3442
Toll-free: (888) 244-4379
www.wildridge.com/

$89.95 per CD-ROM package (Power Mac)
Note: Windows version also available for the same price. Order no. 97W-1-1-1500.

This CD-ROM provides a comprehensive background in the science of astronomy through seven multimedia exercises. The CD-ROM consists of Print Materials, which are included on the disc, and Multimedia Exercises. Print materials include a textbook, a teacher's guide, and myths related to the major constellations, as well as a student guide, an assignment checklist, and study questions with enrichment problems. The textbook provides reading material upon which every investigation of the CD-ROM is based. As students study each section in the textbook, the multimedia exercises help them understand and apply what they have learned. The main menu of the CD-ROM provides seven exercises, a slide show, a list of related Internet sites, and an explanation of connections between astronomy and mythology. It also includes challenge tests that draw upon the textbook and the multimedia exercises, progress reports that track students' progress through the multimedia exercises, and a glossary. The multimedia exercises further the work of the texts in involving students in math and science activities related to understanding astronomy. Exercises cover angles, trigonometry, graphing, scientific notation, and three types of motion (linear, rotary, and oscillatory). These concepts are applied in such activities as measuring latitude and longitude; determining the distance to and between certain stars; and investigating constellations and related myths. In a sample project on motion, students simulate Venus's retrograde motion by marking on the wall where Venus appears to be among the stars until a person who is representing Venus has passed a person representing the Earth. (Author/YK) ENC-016720

Physics

Fun With Physics: Real-Life Problem Solving for Grades K-3

Fun with Physics Series

Grades K-3
1999
Author: Sheri E. Bidwell; editor, Cherie Morrow

Ordering Information
Center on Education and Training for Employment (CETE)
The Ohio State University
1900 Kenny Road
Columbus OH 43210
(614) 292-4353 / Fax: (614) 292-1260
Toll-free:(800) 848-4815
www.cete.org

$39.95 per book (spiral-bound, paperback)
Note: Also available as a set (with grade 4-8 book). Order # FWP K-8, $70.00

Standards: Benchmarks for Science Literacy (1993); National Science Education Standards (December 1995)

This book provides students with hands-on activities to solve real-life physics problems. The book focuses on concepts and process skills that have been identified in national standards and that are measured by state proficiency tests. The book is divided into three sections. The first provides information about how to start using the ideas found in the book. The second section presents information and insights about relevant learning theories and their practical application, such as inquiry-based learning, process skill development, and gender equity. The Learning Activities section is divided into physics categories: simple machines, electricity, heat, and liquids. For each activity section, the book provides materials lists, background information, and procedures for activities, from engagement to extension. These are accompanied by connections to other subjects and resources for teachers and students. Reproducible student worksheets and datasheets are also provided. The appendices provide a variety of support materials such as references, basic scientific principles, and a matrix of learning activities, proficiency outcomes, and process skills. Also available from this series is Fun with Physics: Real-Life Problem Solving for Grades 4-8, which uses a similar format and content for more advanced students. (Author/YK) ENC-014463 & ENC-014462

Gravity Rules!

AIMS Activities

Grades 5-12
1998
Author: Betty Cordel, John Ervin, Ronald Koop, Tracey Lieder, Renee Mason, Johann Weber, Jim Wilson; executive producer, Ronald Koop

Ordering Information
AIMS Education Foundation
PO Box 8120
Fresno, CA 93747
(559) 255-4094 / Fax: (559) 255-6396
Toll-free: (888) 733-2467

$29.95 per video
$16.95 per activity book (paperback)
Note: Activity book and video can be ordered together (Order # 4075) for **$36.95.**

Standards: Benchmarks for Science Literacy (1993); National Science Education Standards (December 1995); NCTM Curriculum and Evaluation Standards (1989)

This book and videotape uses the sport of skydiving to study force and motion. The video portion of the package provides students with footage of people skydiving and instrument readings within an airplane in flight from which they collect data. The data are then used to compute a physical characteristic of a real-world object. The standards-based, hands-on activities in the book use paper models to duplicate what the students observe on the video. The series integrates mathematics and science with other curriculum areas including language arts, social studies, physical education, art, and music. Both the video and the book explain the design of the equipment and the instruments that the parachutists and the pilots use. Students explore the movements that the parachutists make to understand how changes in their arm and leg positions relate to specific maneuvers and laws of physics. They make mathematical calculations to determine average velocity, terminal velocity, and glide ratio. Each activity lists the key questions, corresponding standards, and integrated disciplines as well as procedures and materials. Reproducible pages are found throughout the book. On the video, teachers can find additional technical information, such as how to set up the computers and graphing calculators involved in a computer-based lab. (Author/JR) ENC-016167

Communication

Active Physics Series

Grades 9-12
1999
Author: Arthur Eisenkraft

Ordering Information
IT'S ABOUT TIME Inc
84 Business Park Drive, Suite 307
Armonk, NY 10504
Fax: (914) 273-2227
Toll-free: (888) 698-8463
Email: itstimefor@aol.com
www.its-about-time.com

$49.95 per video
$36.95 per teacher's edition (paperback)
Note: Supplemental materials and resource packages also available.
$14.95 per student text (paperback)
Note: Contact vendor for discount information.

Standards: National Science Education Standards (December 1995)

This curriculum module presents the physics of music and long distance communications. Active Physics, an activity-based curriculum with limited math and reading skills prerequisites, is designed as an introductory physics course for high school students, or an alternative for those who would not normally enroll in physics. Each module in the course uses a thematic approach in which students learn about physics as they explore issues in Sports, Medicine, Home, Transportation, and Predictions. This module contains three chapters that focus on the applications of sound and light, wave theory, and the electromagnetic spectrum. Each chapter presents students with a problem or task that they will complete using the knowledge they gain in the chapter. Students begin the module by using a slinky to observe pulses, periodic and standing waves, and to establish the relationships among wavelength, frequency, and speed of the wave. In other activities, students use waves to communicate by creating a simple code of pulses to send messages; explore the use of pixels in binary coding and electronic images; and explore the Doppler effect through an experiment in which they toss an oscillator embedded in a Nerf ball. The activities conclude with reflective readings that relate the activity to the larger challenge, homework problems, and extensions. The teacher's guide provides an overview of Active Physics and its correlation to the *National Science Education Standards* (1995). For each chapter, the guide provides a chapter organizer, a summary of physics concepts addressed, and equipment lists as well as annotated student pages, assessment rubrics ,a traditional chapter test and answer keys. The companion videotape demonstrates how to carry out each activity in the classroom. (Author/LCT) ENC-015868

Chemistry

Soda Science: Designing and Testing Soft Drinks

Boston Children's Museum Activity Book

Grades 3-7
1997
Author: Bernie Zubrowski

Ordering Information
William Morrow & Company
1000 Keystone Industrial Park
Scranton, PA 18512-4621
Fax: (800) 822-4090
Toll-free: (800) 843-9389
www.williammorrow.com

$14.95 per activity book (hardcover)

This book contains recipes and experiments that introduce students to the chemical makeup of soft drinks as well as to some of the chemical techniques used to manufacture them. The book is divided into four sections that approach three different aspects of soda pop. The first part presents a series of investigations that

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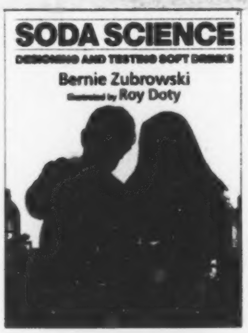


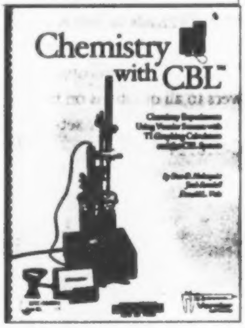
show how colors and flavors are extracted from natural materials. Each experiment includes directions for taking samples at intervals throughout the process and suggestions for comparing them and organizing the data. The second part of the book presents three methods for adding fizz to soft drinks through yeast fermentation, adding sodium bicarbonate, and dissolving carbon dioxide gas into water. The third section provides systematic strategies to help students combine ingredients to make their own soda. This section also describes how to design a survey to test the recipe on other people, how to collect the data, and present it in charts and graphs. The fourth part describes how the ingredients in commercial sodas can be measured and helps readers compare their home product to commercial drinks. Each experiment begins with an introductory discussion and contains a list of household ingredients, an illustrated procedure, and suggestions for other experiments to try. Additional scientific information is provided at the end of each set of experiments. (Author/LCT) ENC-016480

Chemistry With CBL: Chemistry Experiments Using Vernier Probes and Sensors with the CBL System and TI-82, 83, 85, 86, 89 and 92 Graphing Calculators

Grades 9-12
1998
Author: Dan D. Holmquist, Jack Randall, Donald L. Volz

Ordering Information
Vernier Software
13979 SW Millikan Way
Beverton, OR 97005
(503) 222-2299 / Fax: (503) 277-2440
Email: orders@vernier.com
www.vernier.com

$35.00 per book with 2 disks (1 each, Mac and Windows)



This lab manual and accompanying software provide 36 chemistry experiments. All of the experiments incorporate the Texas Instruments (TI) Calculator Based Laboratory (CBL) System (not included) and Vernier sensors, which are used to collect various kinds of data. These data are then retrieved directly into a TI graphing calculator (not included) so that students can generate graphs, analyze the results, and model the experiment. The experiments cover topics in endothermic and exothermic reactions, fractional distillation, and energy content of fuels, in addition to chemical equilibrium, acid base titration, and lead storage batteries. Each experiment includes student handouts with instructions as well as a teacher's information section. The accompanying software contains the word processing files for the student handouts and the CHEMBIO data collection program for the TI graphing calculators. The student sheets include sections on background information, set up diagrams, and detailed instructions on how to use the TI-82, 83, 85, 86, 89, and 92 graphing calculators and the CBL, as well as data and calculation sheets. The teacher's information section that follows each experiment has sample results, answers to questions, directions for preparing solutions, and other helpful hints regarding the planning and implementation of a particular experiment. With the accompanying Vernier software, students can collect data using probes such as a temperature probe, a pressure sensor, a voltage probe, and a colorimeter. The software also enables students to download activity programs and sample data using the TI Graph Link software and cable package (not included). Appendices provide information about how to calibrate probes, how to use the TI-82, 83, 85, 86, and 92 graphing calculators with the CBL system, and how to use the Vernier Graphical Analysis software with the CBL. Also available from this series is Physical Science with CBL: Physical Science Experiments Using Vernier Probes and Sensors with the CBL System and TI-82/TI-83 Graphing Calculators. This resource provides 40 physical science laboratory activities that cover topics in properties of matter, simple machines, and electricity and magnetism, in addition to chemical reactions, acids and bases, and energy alternatives. (Author/YK) ENC-016094 & ENC-016092

ChemMatters

Grades 10-12
1998
Author: American Chemical Society

Ordering Information
American Chemical Society (ACS)
Department 1195
1155 16th Street NW
Washington, DC 20036
(800) 209-0423 / Fax: (202) 872-6067
Toll-free: (800) 227-5558
www.acs.org/edresources.html

$10.00 per general subscription
$4.00 per subscription to teacher's guide

This magazine and accompanying teacher's guide contains four *ChemMatters* issues from October 1998 to April 1999. *ChemMatters*, a chemistry magazine, is issued four times a year for chemistry students by the American Chemical Society. *ChemMatters* explores the basic chemistry behind commercial and consumer products through articles, puzzles, and cartoons. Each issue features articles that demonstrate how chemistry is all around us and tells stories of how chemistry affects our lives. Many issues also contain a section on Mystery Matters that describes real-life mystery stories solved through chemistry. Sample topics include how to take the caffeine out of coffee using supercritical fluid extraction, the development of biodegradable polymers, and the chemical components of the colors produced by fireworks. The teacher's guide provides an overview of each article, a sample lab activity with detailed procedures and review questions, and ideas for further investigation. (Author/YK) ENC-016648

Chemistry in the Marketplace

Grade 10 and up
1998
Publisher: Harcourt Brace & Company
Author: Ben Selinger

Ordering Information
American Chemical Society (ACS)
Department 1195
1155 16th Street NW
Washington DC 20036
(800) 209-0423 / Fax: (202) 872-6067
Toll-free: (800) 227-5558
www.acs.org/edresources.html

$49.95 per book (paperback)

This text provides students with everyday chemistry information to help them connect the theoretical with the familiar. The book features sample experiments and demonstrations to further clarify the topic, interesting anecdotes, and exercise questions. It also features critiques of popular misconceptions of the greenhouse effect, the ozone layer, and viability of alcohol as a motor fuel. The text is structured in 16 chapters that provide an introduction to the language of chemistry, an approach to toxicology and risk assessment, and chemistry in the kitchen. Subsequent chapters explore chemistry in the garden, home safety, and the chemistry of energy, as well as the controversy associated with food irradiation. In a sample chapter on chemistry in the kitchen, students learn about what effect pasteurization has on the nutrients in milk, why microwave ovens are so efficient for cooking, and why dieting can be counterproductive in terms of the metabolic rate of the body. In sample experiments, students demonstrate the existence of iron in breakfast cereal using a strong magnet, and test for the presence of starch by adding a small drop of iodine solution to a starch solution made from a piece of potato. An expanded glossary and an index are also provided. (Author/YK) ENC-015982

Probability

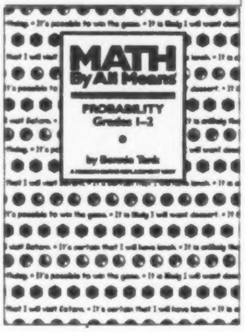
Probability Grades 1 to 2
Math by All Means Series

Grades 1,2
1996
Publisher: Math Solutions Publications
Author: Bonnie Tank

Ordering Information
Cuisenaire Company of America, Inc.
10 Bank Street
PO Box 5026
White Plains, NY 10602
Fax: (800) 551-7637
Toll-free: (800) 237-0338
Email: info@cuisenaire.com
www.cuisenaire-dsp.com

$23.95 per book
$75.00 per kit
Note: Kit includes 400 color tiles, two color counters, 36 dice, 12 menu posters, and color tiles, two color counters and dot dice for the overhead projector.

Standards: NCTM Curriculum and Evaluation Standards (1989)



This five- to six-week unit uses hands-on games and experiments to help students explore the likelihood of events, make predictions about outcomes based on data, and determine whether games are fair. Each unit in the Math by All Means series integrates the primary topic with the rest of mathematics by including ideas from other strands. (This unit on probability also incorporates ideas from the strands of number, computation, geometry, and statistics.) Writing is incorporated as an integral part of children's mathematics learning. Each book is comprised of four components: whole class lessons, menu activities, assessments, and homework. Menu activities allow children to work independent of the teacher in groups, pairs, or individually. These activities do not build on each other, but rather pose problems, set up situations, and ask questions. Woven through each unit are descriptions of what happened when the material was taught to an actual class. These vignettes provide a view of how the lessons were organized, how children reacted, and how a teacher responded in one classroom, but are not intended as a standard of what should happen. Ideas for informal and formal assessment are provided. Teacher materials include blackline masters, tips for calculator use, samples of children's work, a suggested daily schedule, and a sample letter to parents. Also available from this series is Probability Grades 3 to 4, which provides a broad range of problem-solving experiences. Use of materials such as number cubes, spinners, color tiles, and two-color counters is described. (Author/GMM) ENC-007727 & ENC-007728

Between Never and Always: Probability
Investigations in Number, Data, and Space Series

Grade 5
1996
Publisher: Dale Seymour Publications
Author: Margie Singer, Cliff Konold, Andee Rubin

Ordering Information
Scott Foresman Addison Wesley
PO Box 2649
4350 Equity Drive
Columbus, OH 43216
Fax: (800) 841-8939
Toll-free: (877) 260-2530
www.scottforesman.com

$25.25 per book

This teacher's resource book focuses on a few fundamental ideas about probability. The Investigations in Number, Data, and Space series provides a complete K to 5 mathematics curriculum that offers students meaningful mathematical problems emphasizing depth in mathematical thinking. In contrast to the usual textbook-based program, the curriculum is presented through a series of teacher books, one for each unit of study. Reproducible resources for students are provided, but the curriculum does not include student books. Students work actively with a variety of manipulative materials and technology. Between Never and Always contains two Investigations. One takes five, one-hour sessions, while the other takes seven. Activities include pair and small group work, individual tasks, and whole class discussions. The opening pages of each Investigation present a synopsis of each session, an overview of the most important mathematical ideas that students will encounter, and a list of materials to gather. One Investigation emphasizes how probability can be related to games. In Sessions 1 and 2, students play a three-person version of Rock, Paper, Scissors that is not fair. After collecting data, students enumerate all the possible ways for each player to win and discover the game is indeed unfair. Groups then modify the rules of the game to make it fair. In other sessions, students discuss games that involve chance only, skill only, and a combination of the two. They are introduced to a new game, and class results are used to prompt a discussion of what it means for a game to be fair. Homework assignments and extensions appear at the end of each activity. A variety of embedded assessment activities are recommended throughout. (Author/CMS/KFR) ENC-010725

Probability
Task Card Series

Grades 7-12
1996
Author: Ron Marson

Ordering Information
TOPS Learning Systems Orders
10970 S. Mulino Rd.
Canby, OR 97013
(503) 266-8550 / Fax: (503) 266-5200
www.topscience.org

$13.00 per activity book (paperback)

This book contains 28 reproducible student activity cards to involve students in the mathematics of chance and the science of analysis. Activities include counting, permutations, tallying combinations, and plotting frequency distributions. Students work alone or in cooperative groups to complete activities at their own pace. Each student is responsible for a brief, individual write up explaining the how and why of the activity. In one activity, students flip a coin in a marathon basketball tournament and try to answer the question: Is Heads or Tails really the better team? In another activity, students turn a cereal box into a penny pinball machine based on Pascal's Triangle and determine the probability of hitting each pin. Included in the book are answers to all questions on the Task Cards along with suggestions for assessment and use of other sets of activity cards in the series. (Author/JRS) ENC-016124

Measurement

The Master Ruler

Grades 2-8
1998
Author: Donna Monck

Ordering Information
Master Innovations, LLC
PO Box 906
Alpha, NJ 08865
(908) 859-1788 / Fax: (908) 859-3141
Email: themasterruler@hotmail.com

$5.00 per book
Note: Rulers are also available for separate purchase; bulk order discounts available. Contact vendor for further information.

This twelve-inch, multi-layered ruler is designed to help students learn the fractional parts of an inch and build skills using half to one-sixteenth inch measurements. The ruler consists of five clear plastic layers that are color coded and index tabbed for easy identification and separation. Each colored layer is marked to measure a different fractional part of an inch. All layers are attached with plastic rings and can overlay each other. Included with the ruler is a booklet with activities that begin with elementary measuring skills and progress to more difficult concepts, such as equivalent fractions. In sample activities, students use the ruler to measure drawings of flowers growing in pots to the quarter inch, to measure pictures of pencils to the one-sixteenth inch, and to interpret scale drawings and maps. All answers to the activities are included. (Author/JRS) ENC-015648

From Paces to Feet: Measuring and Data
Investigations in Number, Data, and Space

Grade 3
1995
Author: Karen Economopoulos, Jan Mokros, Rebecca B. Corwin, Susan Jo Russell

Ordering Information
Scott Foresman Addison Wesley
PO Box 2649
4350 Equity Drive
Columbus, OH 43216
Fax: (800) 841-8939
Toll-free: (877) 260-2530
www.scottforesman.com

$25.25 per book

General information about the Investigations in Number, Data, and Space series is available on page 74. This book on linear measurement contains four Investigations, each consisting of three to seven one-hour sessions. One Investigation, Measuring with Paces and Steps, emphasizes measuring with non-standard units and analyzing and comparing different measurements. In Session 1, students use baby steps and giant steps to measure distances in the classroom, and in Session 2, students compare the number of units that are needed to cover a particular distance with different-sized steps. In later sessions, pairs of students take turns giving each other directions from one point to another involving a number of steps and turns, then focus on the advantages of standardizing their paces for more uniform measurements. (Author/CMS/KFR) ENC-010490

The Right Angle
New Adventures of Jasper Woodbury Series

Grades 5-8
1996
Publisher: Learning, Inc.
Author: Learning Technology Center, Peabody College, Vanderbilt University

Ordering Information
Optical Data School Media
512 Means St NW, Suite 100
Atlanta, GA 30318
(404) 221-4500 / Fax: (404) 221-4520
Toll-free: (800) 524-2481
www.opticaldata.com

$245.00 per laserdisc package

Standards: NCTM Curriculum and Evaluation Standards (1989)

This laserdisc with teacher's manual contains the story of a young Native American who is challenged by her grandfather to find the cave where a family heirloom is hidden. As the story unfolds, students learn about topological maps, triangles, and the usefulness of geometry for measuring. The series is intended to develop problem-solving skills in contextual, real-life settings. Each of the nine JASPER episodes is on a laserdisc and comes with a related teacher's manual that includes student materials and a computer software disk. At the beginning of each episode, students view a 15- to 25-minute movie from the laserdisc introducing the fundamental concepts, the original story with characters, and the challenge. They then view several shorter movies that present directions, questions, and data. To solve the challenge, students apply mathematics concepts and skills; in this Right Angle episode, for instance, students decode the directions to the cave given in the story, use their geometric knowledge to locate the cave on a map, and prepare clear and accurate directions for the rescue squad to find the fastest way to reach the cave. The mathematics involved in this activity includes whole number, fraction, and decimal operations; ratio, proportion, and percents; and similar triangles. The teacher's manual provides an activity preview, an overview of the solution, teaching suggestions, and a sample lesson plan. Also found are analogous problems and extensions into other content areas. Student materials include pictures of characters, print copies of data from the story, frame numbers of specific scenes, and a story summary. The software disk provides an optional function that allows viewers to select particular story scenes. (Author/CCC/JRS) ENC-013834

Through the Eyes of Explorers: Minds-On Math and Mapping
AIMS Activities

Grades 5-9
1994
Author: Sheldon Erickson

Ordering Information
AIMS Education Foundation
PO Box 8120
Fresno, CA 93747
(559) 255-4094 / Fax: (559) 255-6396
Toll-free: (888) 733-2467

$16.95 per activity book (paperback)

Standards: NCTM Curriculum and Evaluation Standards (1989); Project 2061 (1985)

This teacher resource book introduces mapping with interdisciplinary units based on historical themes. The mathematical focus includes reasoning, measurement, and geometry in the real world. The AIMS series provides integrated mathematics and science units for all grade levels. Unit activities can relate to other curriculum areas including language arts, social studies, physical education, art, and music. In this book the activities are divided into five units. The mathematical concepts of the units grow progressively more complex, allowing students to enter the material at a level that is appropriate for them. Four of the five units begin with historical context that deals with the mapping of the United States for its westward expansion. In a sample activity, students read a series of historical journal entries and develop an itinerary of the travels of a fur trapping expedition that occurred in 1832. From the journal entries, students calculate distances traveled each day and for the entire trip, then determine the path of fur trappers on a map. Through the Eyes of Explorers includes correlations for each activity to Project 2061 *Benchmarks* and NCTM *Curriculum and Evaluation Standards for School Mathematics*. All activities come with detailed background information, teaching suggestions, and classroom discussion questions, along with illustrated student activity sheets and ideas for extending the activity. (Author/JRS) ENC-016207

Measurement
Authentic Learning Activities in Middle School Mathematics Series

Grades 6-8
2000

Ordering Information
Brendan Kelly Publishing
2122 Highview Drive
Burlington, ON L7R 3X4
(905) 335-3359
Fax: (905) 335-5104
www.brendankellypublishing.com

$16.95 per activity book (paperback)
Note: Bulk pricing available. Contact vendor for further information.

The Authentic Learning Activities in Middle School Mathematics series contains lessons designed to capture the spirit and intent of the draft of NCTM *Principles and Standards for School Mathematics* (PSSM). Each book in the series addresses one of the five content strands found in PSSM. Part One of each book outlines the mathematical underpinnings, and Part Two provides a brief instruction on the new content or approaches found in that strand. Parts Three and Four provide two authentic learning tasks, each consisting of a set of four activities with reproducible work sheets. Each learning task includes background for the teacher and detailed classroom instructions along with an answer key and samples of student work. Measurement contains student activities exploring the relationships among the areas of triangles, rectangles, parallelograms, and trapezoids. In the first unit, students join Gulliver on his travels to Laputa, the land of mathematicians. Students read brief, modernized excerpts from *Gulliver's Travels* and rewrite a paragraph that confuses the names of two-dimensional and three-dimensional figures. Students estimate and calculate perimeters and areas of triangles and quadrilaterals shown on a grid and decompose larger shapes into simple shapes such as right triangles. They then compute perimeters using the Pythagorean relationship and apply area formulas. In later activities, students help the mathematicians escape the King's tax on right angles by transforming rectangles into trapezoids of equal area. This book includes a selected list of related print and media resources and Internet addresses. (Author/JRS) ENC-016680

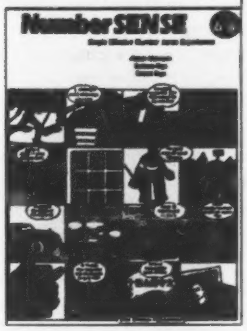
Number SENSE: Simple Effective Number Sense Experiences, Grades 6-8

Number SENSE Series

Grades 6-8
1997
Author: Alistair McIntosh, Barbara Reys, Robert Reys

Ordering Information
Dale Seymour Publications
4350 Equity Drive
PO Box 2649
Columbus, OH 43216
(800) 237-3142 / Fax: (800) 393-3156
Toll-free: (800) 231-3106
www.pearsonlearning.com

$19.95 per activity book (paperback)



The Number Sense series is designed to promote reflection about numbers with primary through middle school students. Each volume is divided into six sections that explore the major components of number sense: estimation, measurement, and mental computation along with multiple representation, number relationships, and relative size. The underlying philosophy is that number sense is often developed from visual experiences. Teacher notes explain the intent of each section, while each experience lists the number focus, provides the needed mathematical background, and suggests ways to use the activities in the classroom. Solutions and extensions are provided. The book for grades 6 to 8 contains 40 experiences, each broken into several five- to fifteen-minute activities. In one experience, students engage in four activities that encourage them to think about doing computations mentally and to reflect on appropriate computational alternatives. The four activities become progressively more difficult, moving from the four operations to finding percentage. Students look at twelve similar computation problems and consider whether each calculation can be performed mentally with ease, with great difficulty, or in between. Students then pick which computation in the set is the most difficult for them to do mentally and discuss their choices. In an extension activity, students make up two new computations, one that is easy to do mentally and one that is hard, and explain their reasoning. All activities in this book are reproducible; references are included. (Author/JRS) ENC-016338

Flea-Sized Surgeons

EQUALS investigations Series

Grades 6-9
1994
Author: Lawrence Hall of Science, University of California at Berkeley

Ordering Information
EQUALS Publications
University of California, Berkeley
Lawrence Hall of Science #5200
Berkeley CA 94720
(510) 642-1910 / Fax: (510) 643-5757
Toll-free: (800) 897-5036
Email: equals@uclink.berkeley.edu
www.etdc.wednet.edu/equity/organizations/18.html

$22.00 per book
$100.00 per set of 5 books

Standards: NCTM Curriculum and Evaluation Standards

The Investigation Units series was conceived and designed by the Investigations Mathematics Curriculum Project as a part of the EQUALS, a teacher education program designed to help elementary and secondary teachers acquire methods and materials to attract minority and female students to mathematics. The series supports a problem solving approach to mathematics; students work in groups, and teachers use active assessment methods and incorporate a broad mathematics curriculum presented to students in a variety of contexts. Each unit has a range of entry levels that allow students of varying experience to be challenged. The units integrate language, writing, and hands-on work in cooperative settings and are designed to be used in bilingual or multilingual settings. Student pages are in English and Spanish. Flea-Sized Surgeons is a four- to eight-week unit addressing the topics of surface area, volume, and scale. Students build mathematical models to help them question how scale changes affect measurements of physical properties (such as lightness on feet, heat transfer, respiration, strength, and stability of form) in animals and people. Also available from this series is Telling Someone Where to Go, in which students explore the mathematics of navigation in the spirit of the wilderness sport of orienteering. (Author/GMM) ENC-008619 & ENC-008618

Fractals

A Fractals Lesson for Elementary and Middle School Students

math.rice.edu/~lanius/frac

Grades 4-8
Author: Cynthia Lanius
Standards: NCTM Curriculum and Evaluation Standards (1989)

This web site describes how to make fractals by iterating within an equilateral triangle. The goal of the site is to explore mathematics and to find real-life objects similar to fractals, such as ferns, coastlines, and mountains. The lesson plan is designed so that students can work independently. Alternative assessment methods are suggested. Links to other fractal sites are available by clicking the appropriate word or phrase. Winner, ENC Digital Dozen, August 1996. (Author/LDR) ENC-002032

Infinite Windows Classroom Instructional Resources

Interactive Mathematics Series

Grade 8
1996
Author: David Foster, Sandie Gilliam, Jack Price, Kay McClain, Barney Martinez, Linda Dritsas

Ordering Information
Glencoe/McGraw-Hill
PO Box 543
Blacklick, OH 43004
(614) 890-1111 / Fax: (614) 860-1877
Toll-free: (800) 334-7344

$86.73 per kit
Note: Includes teacher's edition, transparencies, menu station posters, and cooperative group discussion cards. Price may very. This price is for teachers ordering through their schools. Contact publisher for additional ordering options.

Standards: NCTM Curriculum and Evaluation Standards (1989)

The Interactive Mathematics series consists of 18 units that help students construct their own mathematical understanding by using activities, projects, and investigations in a problem-solving, cooperative learning setting. Each unit opener is the story of a teenager who uses mathematics in a real-life situation. Infinite Windows is a five-week unit containing activity-based materials for introducing iteration, fractal geometry, and chaos theory. The unit is introduced with the story of a successful student with high aspirations who was killed in an auto accident. Students complete seven activities and two investigations in which they explore repeated reflections with mirrors and create fractals by folding and cutting paper and by plotting random numbers. They also use computers to investigate chaos theory and fractals. In another activity, students apply chaos theory through a simulation of the spread of a forest fire using a probability factor, graph paper, and throws of a number cube to simulate changing wind patterns. Included in this set of materials are the student text pages, lesson plans, materials for homework, a letter to parents with a family activity, and suggestions for assessment. Hardcover student texts are also available in Spanish. (Author/JRS) ENC-011580

Fractals: Exploring Its Simplicity, Beauty, and Mathematics

www.best.com/~ejad/java/fractals

Grade 9 and up
Author: Jacobo Bulaevsky

This web site is maintained by Jacobo Bulaevsky, an electrical engineer and math hobbyist. The site presents information and interactive Java Applets on 11 types of fractals and the mathematics behind them. Graphics show how each type of fractal is generated, then Applets help students visualize the iteration rules by allowing them to perform each iteration at the touch of a button. For example, in the Koch Snowflake Applet, students are shown a line. By clicking a button, students see how the line is changed after the first iteration; students can then perform successive iterations until their computer runs out of memory. After producing the fractal, students are asked how the number of iterations relates to the number of line segments in the Koch Snowflake. Students are also given information about fractal dimension and other fractal concepts, such as the initial conditions and the algorithms that determine their shapes. To encourage student exploration, the site has windows that hide answers to the questions. These windows cannot be opened without a password, which teachers can receive from the webmaster. (Author/RMK) ENC-013353

Statistics

The Graph Club with Fizz & Martina

Grades K-4
1998
Author: Peggy Healy Stearns

Ordering Information
Tom Snyder Productions, Inc.
80 Coolidge Hill Rd
Watertown, MA 02172
Fax: (617) 926-6222
Toll-free: (800) 304-1254
www.teachtsp.com

$79.95 per CD-ROM package
Note: Network versions and site licensing also available in English or bilingual (English/Spanish) editions. Specify computer type and disk or CD-ROM.

Standards: NCTM Curriculum and Evaluation Standards (1989)

This CD-ROM is designed to help students develop the ability to interpret graphs and to use graphs to communicate information and solve problems. The program is intended to assist students in making the transition from graphing with manipulatives to graphing in the abstract and to help them understand the relationship between different representations of the same data—for example, picture graph, bar graph, line graph, circle graph, and table. Students learn that data come from many sources and that they are used for a variety of purposes. EXPLORE mode generates a pair of graphs that lets students investigate graphing in an open-ended environment. MATCH mode generates a random graph and challenges students to create a different type of graph representing the same data. CREATE mode permits students to enter collected data for graphing. GUESS mode encourages critical thinking skills and helps students to understand that there are often many good answers to a question. Other options allow students to label and even write about their graphs in a text box. The teacher's guide includes blackline masters of sample graphs and activities as well as suggestions for how to introduce and assess graphing concepts in the primary grades. (Author/LDR/GMM) ENC-014421

Survey Questions and Secret Rules: Collecting and Sorting Data

Investigations in Number, Data, and Space Series

Grade 1
1998
Publisher: Dale Seymour Publications
Author: Tracey Wright, Jan Mokros

Ordering Information
Scott Foresman Addison Wesley
PO Box 2649
4350 Equity Drive
Columbus OH 43216
Fax: (800) 841-8939
Toll-free: (877) 280-2530
www.scottforesman.com

$26.25 per teacher's guide

See a general description of the Investigations in Number, Data, and Space Series on page 74. This book, which focuses on understanding, categorizing, and representing data, contains four Investigations. Each includes three to six one-hour sessions. One Investigation, Birthdays, emphasizes becoming familiar with calendar features as well as grouping, describing, and ordering data about birthdays. In Session 1, students use calendars to make cards showing their birth dates, then organize themselves in groups according to birth month. In other sessions, pairs of students try different ways of organizing the class birthday data, and the whole class listens to a month-by-month story and then creates a group timeline to tell a similar story over one year. Recommendations for homework assignments and for extensions appear at the end of each activity, and various embedded assessment activities are recommended throughout. (Author/CMS/KFR) ENC-010481

Data Explorer

Grades 4-8
1998
Author: design, Lois Edwards; engineering, Information Technology Design Associates

Ordering Information
Sunburst Communications, Inc.
101 Castleton Street
PO Box 100
Pleasantville, NY 10570
(914) 747-3310 / Fax: (914) 747-4109
Toll-free: (800) 321-7511
Email: service@nysunburst.com
www.sunburstdirect.com

$99.95 per CD-ROM package or 10 CD-ROM Lab pack
Note: Please contact vendor for further information and for system requirements.

This CD-ROM allows students to create and administer surveys as a form of data collection and then analyze that data graphically and with basic statistical tools. The survey tool allows students to create multiple-choice surveys that can then be administered online. As the survey is completed, results are stored in a spreadsheet. The data analysis section allows students to explore data from their surveys or from other sources, such as the examples included on the CD-ROM. Students can analyze interval, numerical, or categorical data using many types of graphs, including scatter plots, box plots, pie charts, histograms, and stem and leaf plots. Data Explorer also calculates basic column statistics for numerical data. Each time a graph is produced, a menu specific to that type of graph allows students to do further explorations. For instance, on the scatter plot, students have the option of including a least squares fitted line or lines having formulas entered by the students. A notebook feature allows students to record observations as they look at a graph, spreadsheet, or survey. The teacher's guide includes a detailed tour of all of the features of the software, as well as a section on teaching data analysis that provides suggestions of various activities. A reference section gives brief operation notes and a bibliography of instructional resources. (Author/RMK) ENC-013370

Data Analysis, Statistics, and Probability
Authentic Learning Activities in Middle School Mathematics Series

Grades 6-8
2000
Author: Brendan Kelly

Ordering Information
Brendan Kelly Publishing
2122 Highview Drive
Burlington, ON L7R 3X4
(905) 335-3359 / Fax: (905) 335-5104
www.brendankellypublishing.com

$18.95 per activity book (paperback)
Note: Bulk pricing available. Contact vendor for further information.

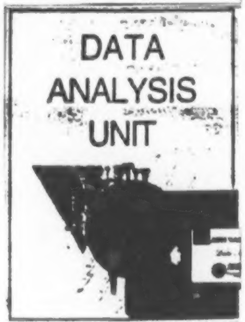
The Authentic Learning Activities in Middle School Mathematics Series is described on page 75. This teacher resource book from the series contains activities that challenge students to use data and probability to determine if the African elephant will become extinct in their lifetime and to decide if the World Series is rigged. In the first unit of the book, students estimate the number of elephants in a herd using an aerial photograph on which a rectangular grid is superimposed. Students count the number of animals in a random selection of rectangles and estimate the number of elephants in the entire herd. By pooling their results, students learn how the estimates become more accurate as the sample size is increased. Students use appropriate graphs to show various information about elephant populations. Finally, they visit web sites to investigate opinions of Africans about the ivory trade, then write a report with quantitative information to support or refute the assertion that the African elephant will become extinct in the students' lifetime. The book includes a selected list of related print and media resources and Internet addresses. (Author/JRS) ENC-016681

Data: How Do You Get It?
Math Vantage 1995 Series

Grades 6-9
1996
Author: Nebraska Mathematics and Science Coalition

Ordering Information
Great Plains National
PO Box 80669
Lincoln, NE 68501
(402) 472-2007 / Fax: (800) 306-2330
Toll-free: (800) 228-4630
Email: gpn@unl.edu
gpn.unl.edu

$145.00 per kit
$39.90 per video
$5.00 per teacher's guide



The Math Vantage series aims to motivate pre-algebra students with high-energy footage of real-world situations illustrating key mathematical concepts and applications. This videotape, the first in a four-tape unit, introduces students to the study of statistics; the emphasis is that data collection and analysis are important skills for modern life. The tape shows how surveys, observation, analysis of past records, and experimentation are used for data collection. Examples include how a survey is constructed to gather data about the appeal of different toothpastes, why the observation of traffic patterns is an important source of data, and how past records are helpful to a women's college basketball coach when making game playing decisions. The material also shows how experimentation in a controlled environment can be a source of useful data. In this segment, a scientist describes how a replica of minnows' river environment is used in experiments investigating the relationship between an independent variable, a predator, and the survival of minnows, the dependent variable. Another segment of the video illustrates how data resulting from crash tests with dummies are used by civil engineers to make safety recommendations. A teacher's resource book includes lesson plans, assessment ideas, and student worksheets. (Author/JRS) ENC-014557

Statistics. Polls: What Do the Numbers Tell Us?
www.learner.org/exhibits/statistics

Grade 7 and up
1997
Author: Janice Hadfield, Ellen Rauch, Henry Thaggert; project managers, Linda W. Braun, Jennifer Fleming

This web site, part of the Annenberg/CPB Exhibits Collection, opens with a four question survey about the visitor's views on the polling process and what the visitor looks for in a political candidate. The site then follows a year in a fictitious election campaign and offers an inside look at the mathematics behind the polls and the news heard everyday. The information is designed to answer the question, What do polling figures mean and where do they come from? The site, with politically related vignettes as background, describes the use of such statistical tools as random samples, margins of errors, and confidence intervals. Included is a Java Applet to help students understand confidence intervals. Also found are explanations of the sources of survey errors and of how numbers are used in daily life for such things as taking a census, evaluating climate data, and calculating income-related information. Links to related resources and the results of the initial survey are also provided. Winner, ENC Digital Dozen, November 1998. (Author/JRS) ENC-013626

Rice Virtual Lab in Statistics
ruf.rice.edu/~lane/rvls.html

Grade 9 and up
Publisher: Rice University
Author: David Lane

This web site offers statistical content for high school students. It includes an online college-level statistics textbook and links to other statistics resources on the Internet. Java Applets demonstrate statistical concepts including mean and median, confidence intervals, and regression analysis. Case studies offer examples of real data from research studies along with analysis and interpretation. One case study, Instructor Reputation and Teacher Ratings, addresses the following question: Does an instructor's reputation affect ratings of the instructor's lecture? Statistical tools applied in this case study include boxplots and stem and leaf displays, two-sample t-tests, and analysis of variance. (Author/JRS) ENC-014001

Addison Wesley Longman Internet Projects for Elementary Statistics
hepg.awl.com/weiss/e_iprojects/index.htm

Grade 10 and up

Publisher: Addison Wesley Longman (AWL) (Reading, MA)
Author: Tim Arnold

This web site is designed to complement chapters in an Addison Wesley elementary statistics textbook, but it contains project activities that are useful to anyone interested in statistics and in exploring real-world data with elementary statistics techniques. The site is divided into 14 chapters offering projects based on an assortment of Internet data sources along with interactive graphical tools and simulations for analyzing the data. Projects range from investigating the survivor data from the Titanic to using regression analysis to interpret the results of Assisted Reproductive Technology. One project, Global Warming, begins with online references to help the user understand the mechanisms behind the phenomenon of global warming. Resource materials include a timeline that traces the global warming phenomenon, graphs of temperature over the last 100 years, and information links offering opposing views held by scientists about global warming. The project supports use of confidence intervals to analyze the temperature data collected by the Intergovernmental Panel on Climate Change. Winner, ENC Digital Dozen, January 2000. (Author/JRS) ENC-016350

Functions and Graphs

Tracking Graphs

Mathematics in Context Series

Grades 6 and 7
1998
Author: developed in collaboration with the Wisconsin Center for Education Research, School of Education, University of Wisconsin-Madison and the Freudenthal Institute at the University of Utrecht, the Netherlands

Ordering Information
Encyclopedia Britannica Inc
Mathematics in Context
310 South Michigan Avenue
Chicago, IL 60604
Fax: (312) 347-7903
Toll-free: (800) 554-9862
www.britannica.com

$5.35 per student book
$21.55 per teacher's guide

Standards: NCTM Curriculum and Evaluation Standards (1989)

The Mathematics in Context series offers a complete middle school curriculum encompassing ten units per grade level; each unit is designed to place mathematical content into a variety of real-world contexts. The program's content is divided into the strands of number, algebra, geometry, and statistics. For each unit, a teacher's guide includes lesson overviews explaining the purpose of the unit and teaching strategies, student materials, and blackline masters for a letter to families, student activity sheets, and assessment. Tracking Graphs, a student book with teacher's guide, contains a 13-day unit in which students produce line graphs, read data from graphs, and learn to analyze a graph's essential features. In a sample lesson, Graphing of Tides, students investigate data about tides and use the information to make decisions on whether ships can enter a harbor or not. They also produce and examine a vertical translation or shift of a graph. Teacher materials for this unit, part of the algebra strand, include suggestions for informal assessment, extensions, and journal writing, and formal assessment activities using data related to a presidential campaign, trends of women in the work force, and the Olympics. Also available from this series is Growth, designed for grades 8 and 9. This unit introduces students to mathematical modeling as they explore linear, quadratic, cubic, and exponential formulas and graphs. (Author/JRS) ENC-012882 & ENC-012983.

Patterns, Functions, and Algebra

Authentic Learning Activities in Middle School Mathematics Series

This book, part of the Authentic Learning Activities in Middle School Mathematics described on page 75, contains activities that develop algebraic concepts in the context of searching for patterns. In the first unit, students are introduced to the idea that mathematics is the accumulation of intellectual contributions from many societies and cultures. Students explore the sequence of triangular numbers, first with manipulatives and then using tables. In later activities, students work with Pascal's triangle and learn about its relationship to Chinese culture of the 14th century. In other historic connections, students learn of Arab and Hindu contributions to mathematical development and learn of Gauss's method to find an expression for the sum of the numbers from one to n. This brings them to an alternative way to derive an algebraic formula for the nth triangular number. In the second unit in the book, students use linear functions to find the most economical of three potential locations for a fund raising party. The book includes a selected list of related print and media resources and Internet addresses. (Author/JRS) ENC-016682

Grades 6-8
2000
Author: Brendan Kelly

Ordering Information
Brendan Kelly Publishing
2122 Highview Drive
Burlington, ON L7R 3X4
(905) 335-3359 / Fax: (905) 335-5104
www.brendankellypublishing.com

$16.95 per activity book (paperback)
Note: Bulk pricing available. Contact vendor for further information.

Thinking With Mathematical Models: Representing Relationships

Connected Mathematics Project Series

Grade 8
1998
Publisher: Dale Seymour Publications
Author: Glenda Lappan, James T. Fey, William M. Fitzgerald, Susan N. Friel, Elizabeth Difanis Phillips

Ordering Information
Scott Foresman Addison Wesley
PO Box 2649
4350 Equity Drive
Columbus, OH 43216
Fax: (800) 841-8939
Toll-free: (877) 260-2530
www.scottforesman.com

$6.55 per student book
$18.15 per teacher's guide

Standards: NCTM Curriculum and Evaluation Standards (1989); NCTM Professional Standards (1991)

The Connected Mathematics Project (CMP) series is a complete middle school mathematics curriculum that emphasizes connections among the core ideas of mathematics, between mathematics and other subjects, among classroom activities and student interests, and to applications to the outside world. Each CMP unit contains investigations supporting problem-centered teaching. Instruction is divided into three phases—launch, explore, and summarize—a model that encourages higher-level thinking, problem solving, and making sense of mathematics and its uses. This student text and teacher guide focus on constructing mathematical models, both algebraic and graphic. Students use data from experiments with paper bridges and teetertotters as they learn to use graph and equation models to represent trends in data. In one investigation, students read a story about a bus trip gone array and analyze graphs representing different aspects of the trip. They also create stories that interpret events modeled graphically. In other activities, graphing calculators are used to graph quadratic equations. In a mathematical reflection for the unit, students look at relationships associated with real-life situations that can be represented by graph and equation models. The teachers' guide explains the mathematics a teacher needs to understand to teach the unit; also included are lesson plans, blackline masters, and suggestions for using embedded assessment, journals, portfolios, and testing materials. (Author/JRS) ENC-011888

Algebra Experiments 1: Exploring Linear Functions

Grades 8-10
1993
Publisher: Addison Wesley Publishing Company
Author: Mary Jean Winter, Ronald J. Carlson

Ordering Information
Dale Seymour Publications Orders
4350 Equity Drive
PO Box 2649
Columbus, OH 43216
(800) 237-3142 / Fax: (800) 393-3156
Toll-free: (800) 231-3106
www.pearsonlearning.com

$20.90 per book

Standards: NCTM Curriculum and Evaluation Standards (1989)

This teacher resource book, intended for use with any algebra textbook, contains 17 experiments in which students gather data and construct mathematical models of real-world experiments that can be represented as linear functions. The experiments introduce, develop, and reinforce basic algebra concepts such as slope, intercept, and equation of a line; independent and dependent variables; the properties of a linear function; and the interconnections between the equation of a function and its graph. Each experiment includes teacher notes explaining the experiment, an equipment list, procedural directions, and suggestions for organizing and analyzing class results. For example, in View Tubes students measure the viewable vertical distance on a wall (the independent variable) and consider it to be a function of the distance that the student is standing from the wall (the dependent variable). Working in pairs, students select a tube and take three trial measurements for viewable length on a wall, while standing at six different distances from it. On the data collection worksheet, students draw a diagram of the experiment indicating variables, describe the procedure, organize data on a chart with three trials for each distance x, and create a final x-y table with the trial x-values averaged. The students plot the data and draw a straight line through two points that best fit the data, then find the slope, the y-intercept, and the equation of the line. To interpret the data, students answer a series of questions, such as how the graph would be different if the viewing tube they used were longer or wider. The resource book includes an overview of the use of experiments in the math classroom, reproducible student pages, evaluation and assessment suggestions, and samples of student work. Also available from this series is Algebra Experiments 2: Exploring Nonlinear Functions, which contains 14 experiments in which students gather data and construct mathematical models of the real-world experiments using nonlinear functions and graphing calculators or computers. (Author/JRS) ENC-012451 & ENC-012405

Real-World Math with the CBL System: Activities for the TI-83 and TI-83 Plus

Grades 9-12
1999
Author: Chris Brueningsen, Bill Bower, Linda Antinone, Elisa Brueningsen-Kerner

Ordering Information
Texas Instruments, Inc.
PO Box 650311 M/S 3962
Dallas, TX 75265
(972) 917-6335 / Fax: (972) 917-0747
Toll-free: (800) 842-2737
Email: ti-cares@ti.com
www.ti.com/calc

$22.50 per activity book (includes computer disks; calculators and sensing devices are not included)
Note: Suggested retail price. Call 1-800-TI CARES for vendor referral and pricing (TI indicates that dealers set prices). Contact publisher for system requirements.

This teacher resource book contains 31 activities designed to provide math students, from algebra through calculus, with a way to explore real-world applications of mathematical concepts. All of the activities require use of the Texas Instruments (TI) Calculator-Based Laboratory (CBL) System. Probes and sensors used in data collection include TI's light, temperature, and voltage probes, and Vernier's motion detector, student force sensor, microphone, pressure sensor, and pH meter system. Functions studied include linear, quadratic, exponential, sinusoidal, and piecewise-defined. Each activity is presented in worksheet format with background information, set-up diagrams, general instructions, and space for students to record data and complete exercises. The activities feature CBL programs with onscreen menus and procedures to aid students, especially those with limited knowledge of graphing calculators or the CBL. Each program has an option for retrieving and viewing sample data sets. Diskettes for Macintosh and MS DOS computers allow activity programs and sample data to be downloaded. Students can use one of the programs to link calculators and transfer collected or sample data for individual analysis. Extensions included in most activities allow for independent investigations. Teacher information sheets supply suggestions for completing the activities, as well as sample data plots and answers to student questions. (Author/MPN/JRS) ENC-014537

Physics and Calculus Problem of the Week (PCPOW)
www.kent.wednet.edu/pcpow

Grade 11 and up

Author: Kentridge High School, Dave Wright, Tom Robinson

This web site is designed and maintained by an AP Calculus and an AP Physics teacher as a way to foster an increased enjoyment of advanced math and science concepts through problem solving with a competitive twist. The contest is open to everyone. New questions are posted on the first and third Mondays of each month. At the same time, solutions to the previous week's questions are posted. Prizes include pencils and certificates, a t-shirt winner drawn from the group of entries getting both questions correct, and a yearly grand prize award of a TI 89 graphing calculator. One calculus problem, The 100 Meter Dash!, considers the placement of a camera near the finish line of the 100 meter race at the 2000 Olympics. The goal is to capture on film the predicted winner, Thearcius Functionius, at the historic moment of victory. Using a diagram and further details, contest participants must write an equation for the lens angle (y) in terms of the distance (x) the camera is from the finish line; find dy/dx in terms of x; and determine at what distance from the finish line should the camera be placed. Music and graphics are featured with each problem's statement. Winner, ENC Digital Dozen, March 2000. (Author/JRS) ENC-016771

Background Information for Teachers & Students

Powerhouse: Inside a Nuclear Power Plant (ENC-016308)

Grades K-5
Lerner Publications Company, toll-free: (800) 328-4949 **$22.60**

This text explores the benefits and hazards of nuclear power and covers topics such as what nuclear power is, what radiation is, and how a turbine turns heat into electricity, as well as the problem of nuclear waste, and the future of nuclear power.

Smoking: A Risky Business (ENC-016413)

Grades 2-7
William Morrow & Company, toll-free: (800) 843-9389 **$16.00**

This book examines the history behind tobacco use and its ramifications for personal health and society, looking at the contradictions and controversies resulting from decisions that have been made by individuals, the government , and private industry.

Moon Landing: The Race for the Moon (ENC-016548)

Grades 3-7
DK Publishing, Inc., toll-free: (888) 342-5357 **$14.95**

This reference book, part of the DK Discoveries series, presents an illustrated account of humanity's exploration of the moon, from our first observations and attempts to land to the first landing and later expeditions.

Inventioneering (ENC-016637)

Grades 3-7
Insights Visual Productions Inc., toll-free: (800) 942-0528 **$[illegible]**

This video is an entertaining introduction to the process of inventing new products or processes. It features interviews with adults and children who have had ideas for inventions and are presenting them at professional or junior invention exhibitions across the country.

Spill the Beans and Pass the Peanuts: Legumes (ENC-015961)

Grades 4-7
Lerner Publications Company, toll-free: (800) 328-4949 **$25.26**

This book, part of the Plants We Eat series, contains information about leguminous plants (including peanuts, lentils, peas, and beans, with a special emphasis on soybeans) that pack seeds into pods.

Science in Your Shopping Cart (ENC-016325)

Grades 5-8
Agricultural Research Service Information & Orders, (301) 504-1660 **FREE**

This booklet, produced by the Agricultural Research Service of the United States Department of Agriculture, describes the ways that agricultural scientific research improves the quality of products that are used daily in the United States.

Life Is No Picnic (ENC-015656)

Grade 6 and up
Ambrose Video Publishing, Inc., toll-free: (800) 526-4663 **$99.95**

This video, volume five in the The Learning Channel (TLC) CONNECTIONS 3 series, explains the connections that link instant coffee, early libraries, and jellyfish. Host James Burke shows how war times have catalyzed the expression of creativity in forms such as nylon stockings or the composition of the Star Spangled Banner.

EnviroHealth Link (ENC-014240)

www.mpt.org/ehl/home.html

Grades 6-8

This web site, sponsored by Maryland Public Television and the Johns Hopkins School of Public Health, is designed to provide science and health teachers the resources they need to promote science and health literacy in their classes using today's technology. The site features the mystery of the declining frog populations as the students' inquiry topic.

The Five Biggest Ideas in Science (ENC-016152)

Grades 7-12
John Wiley and Sons, Inc., toll-free: (800) 225-5945

This book provides a humorous look at the process of science and how ideas in five major scientific disciplines have changed through history. The ideas that the author considers the biggest are: the model of the atom, the periodic law, the Big Bang Theory, the plate tectonics model, and the theory of evolution.

Triumph of the Nerds (ENC-016387)

Grade 7 and up
Ambrose Video Publishing, Inc., toll-free (800) 526-4663 **$275.00**

This set of videos provides a humorous look at how the personal computer industry has grown from a hobby for people who like tinkering with electronics, math, and computer code, into a billion dollar business. The narrator describes the way that men such as Steve Wozniak, Steve Jobs, and Bill Gates started as young men and built large companies, Apple and Microsoft.

The Human Genome Project: Cracking the Code Within Us (ENC-016414)

Grades 7-12
Grolier Classroom Publishing Company, toll-free: (800) 621-1115 **$9.95**

This book describes the Human Genome Project, the process of gene mapping, and concerns voiced by the Project's critics. The text follows the activities and thoughts of researchers as they sequence the human genome in order to determine the genetic bases of chromosome-18 syndrome and cystic fibrosis.

Influences of Sun and Moon (ENC-015892)

Grade 7 and up
Ambrose Video Publishing, Inc., toll-free (800) 526-4663 **$99.95**

This video, part of the Forces of the Wild series, illustrates how Earth's revolution and tilt cause seasons to change on Earth, and how the moon's revolution produces the patterns of tides and the phases of the moon depending on the relative position of the sun, the moon and Earth.

Explorers of Hurricanes, Oceans and Space (ENC-015893)

Grade 7 and up
Ambrose Video Publishing, Inc., toll-free (800) 526-4663 **$99.95**

Part of the series described above, this video on explorers of hurricanes, oceans and space introduces students to the marine biologists, filmmakers, and meteorologists in the National Hurricane Center, who study and explore environmental issues, ongoing change in Earth's systems, and related human actions.

Alcohol and Alcoholism (ENC-016157)

Grade 7 and up
Library Video Company, toll-free: (800) 843-3620 **$39.95**

This video, part of the Video Encyclopedia of Psychoactive Drugs, presents the effects of alcohol and the causes and treatment of alcohol abuse. It begins with the statistics of alcohol use in the United States and categorizes alcohol use into social drinking, occasional misuse, and repeated abuse and dependence.

Life by the Numbers: Educational Modules (ENC-014138)

Grades 7-12
Texas Instruments, Inc., toll-free: (800) 842-2737 **$4.00**

This video contains 13 short modules that illustrate the underlying importance of mathematics to everyday life. Mathematical applications as diverse as the way statistics is used and misused in making election predictions and why an ape could never grow to be the size of King Kong are explored.

From A to B, Without C: The English Channel Tunnel (ENC-014733)

Grades 8-10
Institute of Electrical and Electronics Engineers, toll-free: (800) 701-4333 $29.95

This video and resource booklet provide information and activities that help explain the construction and operation of the Channel Tunnel. The video uses the format of a conversation between a nineteenth century French scientist who conceived of a tunnel across the English Channel and a present-day English scientist who works in the control room of the Channel Tunnel.

Strength in Numbers: Discovering the Joy and Power of Mathematics in Everyday Life (ENC-016499)

Grade 9 and up
John Wiley and Sons, Inc., toll-free: (800) 225-5945 **$16.95**

This book uses short historical excursions, written in a conversational style, to introduce the reader to the discoveries and beauty of mathematics. The author's goal is that the reader learn to understand the language of mathematics, have a clearer idea of its importance, and gain an appreciation of mathematical reasoning.

Explosion on the Lady Delia: The Fatal Shift (ENC-016397)

Grades 10-12
Films for the Humanities & Sciences, toll-free: (800) 257-5126 **$149.00**

This video, part of the Periodic Table and the Human Element series, is an exploration of the role played by the element oxygen in the tragic fire on board the British cargo ship, Lady Delia, which left several workers dead. This series uses a highly interdisciplinary approach to introduce some of the characteristics of selected chemical elements.

Who Found the Missing Link? A Gift from Heaven (ENC-016398)

Grades 10-12
Films for the Humanities & Sciences, toll-free: (800) 257-5126 **$149.00**

Part of the series described above, this video explores the role played by Lise Meitner in the crucial research that eventually led to the understanding of the radioactive properties of uranium and the splitting of the atom.

The Strange Story of Napoleon's Wallpaper (ENC-016388)

Grades 10-12
Films for the Humanities & Sciences, toll-free: (800) 257-5126 **$149.00**

Part of the series described above, this video examines the role played by the element arsenic in the mysterious death of Napoleon, whose hair was found to contain high levels of arsenic compounds. The program explains some of the relevant chemistry of arsenic compounds that eventually led investigators to the conclusion that Napoleon was killed by the release of toxic arsenic compounds from his wallpaper.

The Atom That Makes the Difference: A Scattering of Ashes (ENC-016389)

Grades 10-12
Films for the Humanities & Sciences, toll-free: (800) 257-5126 **$149.00**

Part of the series described above, this video addresses the role played by the element carbon in the complex organic molecules synthesized by Carl Djerassi, who called himself the mother of the oral contraceptive. Djerassi takes viewers into the inner circles of synthetic chemistry as he explains the profession's day-to-day workings.

The Human Genome Project: Biology, Computers, and Privacy (ENC-014057)

Grades 10-12
Biological Sciences Curriculum Study, (719) 531-5550, **$5.00**

This software and teacher's guide, second in a series of modules developed by the Biological Sciences Curriculum Study (BSCS), are designed to help students learn about the structure, uses, limitations, and implications of genomic databases. The modules in the series address the issues related to the Human Genome Project, the science of genetics, and the genetic components of behavior.

Humans and Other Animals (ENC-015455)

Grade 10 and up
The Ohio State University Press, toll-free: (800) 437-4439 **$29.00**

This book, a collection of essays that originally were published in a special issue of the journal *Social Research*, addresses the question of what humans' proper relationship with other animals should be. It contains information about how those interactions have been handled throughout history and in different cultures, and how they have been reflected in the arts, religions, and sciences.

Environmental Science: Global Ecosystems Under Stress (ENC-015909)

Grade 10 and up
Kendall/Hunt Publishing Company, toll-free: (800) 770-3544 **$55.95**

This book is a guide to the mechanics of ecology and human impact on the environment. Topics discussed include the carrying capacity of the Earth, family planning, and the use of natural resources such as air, water, and fossil fuels.

Poly(ethylene) (ENC-016441)

Grades 10-12
Films for the Humanities & Sciences, toll-free: (800) 257-5126 **$89.95**

This video, part of the Chemistry in Action series, presents the polymerization of ethylene at different pressures and in the presence of different catalysts, depending on the intended end use of the polyethylene. It shows the molding of polyethylene into commercial products, and the testing and analytical techniques used to determine their properties.

Chemicals from Salt 2 (ENC-016440)

Grades 10-12:
Films for the Humanities & Sciences, toll-free: (800) 257-5126 **$89.95**

Part of the series described above, this video presents how the electrolysis of molten sodium chloride produces pure sodium metal and chlorine gas in a chemical plant.

Physics in the Real World (ENC-015985)

Grades 10-12
Cambridge University Press, toll-free: (800) 872-7423 **$24.95**

This textbook presents the basic concepts and principles of physics. It features numerous worked examples along with detailed solutions and practice problems on the same principles, and sections on the lives of famous scientists.

How Things Work: The Physics of Everyday Life (ENC-016016)

Grade 10 and up
John Wiley and Sons, Inc., toll-free: (800) 225-5945 **$64.95**

This text presents the basic principles of physics using everyday objects to help students connect the theoretical with the familiar. Sample topics include mechanics, heat, and resonance and waves, as well as electricity and magnetism, light and optics, and modern physics.

Probable Tomorrows: How Science and Technology Will Transform Our Lives in the Next Twenty Years (ENC-016370)

Grade 10 and up
St. Martin's Press, St. Martin's Press, toll-free: (888) 330-8417 **$24.95**

This book is a speculative account of the way that near-future advances in products, services, and everyday conveniences might change the way we live and work. The writers consider research under development and historical rates of technological advancement to construct a timetable of likely industrial and cultural breakthroughs.

Aluminum (ENC-016390)

Grades 10-12
Films for the Humanities & Sciences, toll-free: (800) 257-5126 **$89.95**

This video, part of the Chemistry in Action series, presents how aluminum metal is produced from bauxite, an aluminum ore, through an electrolytic method. The program shows how aluminum is extracted and purified from rocks at a British plant by purifying bauxite ore to aluminum oxide and reducing this oxide to molten metal.

Fit to Drink (ENC-016394)

Grades 10-12
Films for the Humanities & Sciences, toll-free: (800) 257-5126, **$89.95**

Part of the series described above, this video examines the water treatment processes of the English Lake District, which uses simple redox and acid base reactions to produce good quality water.

Professional Development

Innumeracy: Mathematical Illiteracy and Its Social Consequences (ENC-014531)

Grade Pre-K and up
Random House, Inc., toll-free: (800) 793-2665 **$12.00**

This book, written by a mathematician, aims to construct a sense of numerical proportion and an appreciation for the probabilistic nature of life in a society where innumeracy (the mathematical equivalent of illiteracy) is dominant.

Data: Posing Answers and Finding Questions (ENC-014204)

Grades K-8
Annenberg/Corporation
for Public Broadcasting, toll-free:
(800) 532-7637 **$24.95**

This professional development video, the second in the Mathematics: What's the Big Idea series, explores the relationship among situations, data, and graphs, and illustrates why statistics and data are important in the mathematics curriculum.

The Future of Mathematics: Ferns & Galaxies (ENC-014210)

Grades K-8
Annenberg/Corporation for Public Broadcasting, toll-free: (800) 532-7637 **$24.95**

Eighth in the series described above, this video aims to familiarize the teacher with the impact of new technologies on what and how mathematics can be taught. It illustrates how discrete mathematics topics, such as recursion and iteration, are becoming accessible to students at a younger age.

Maths in Context: A Thematic Approach (ENC-006927)

Grades K-8
Greenwood Publishing/Heinemann Educational Books Inc., toll-free: (800) 793-2154, **$16.00**

This book is designed to provide guidelines for implementing a thematic approach to mathematics. The author believes that the benefits of using a thematic approach include an increase in students' motivation to learn, the accommodation of students' individual differences, growth in children's confidence in their mathematical ability, and a realization of mathematics applicability to real-world situations.

How to Use Problem-Based Learning in the Classroom (ENC-011848)

Grades K-12
Association for Supervision and Curriculum Development, toll-free: (800) 933-2723 **$18.95**

This book introduces problem-based learning (PBL), a teaching technique that educates by presenting students with a situation that leads to a problem for them to solve. The book also includes five sample PBL units for grades 3, 5, 7, 9, and 11/12.

Apple Learning Interchange: A Dynamic Online Community Where Educators Share, Learn, and Communicate (ENC-016730)

ali.apple.com

Grades K-12

This web site offers an online resource for educators interested in professional development, creating and sharing curriculum resources, and building a worldwide community committed to finding even better ways to teach with technology.

To Half or Half Not: Fractions, Decimals (ENC-013111)

Grades 2 and 3
Public Broadcasting Service, toll-free: (800) 645-4727 **$399.00**

This video on teaching fractions, part of the PBS Mathline series, shows the implementation of a lesson on equivalent fractions that uses fun, hands-on activities to engage student's understanding of the complex concept. Students use geoboards to discover the number of ways to divide rectangles of given sizes into halves. Also on this tape is the lesson entitled Food for Thought: Fractions, Decimals (for grades 4 and 5), which covers estimation and problem solving, and the lesson Soak It Up: Number Sense, Computation (also grades 4 and 5).

Roll out the Barrel (ENC-012337)

Grades 5-8
Public Broadcasting Service, toll-free: (800) 645-4727 **$299.00**

This professional development video for middle school teachers, part of the Magnifying Math Power series, features a lesson in which students investigate the most economical storage arrangement for storing 125 oil barrels. Also available on this tape is the lesson entitled The Smithville Families (grades 5-8), in which students generate the number patterns in Pascal's triangle and investigate the probability of girl/boy combinations in a family of five children. A third lesson on the video, The Great Race, features a lesson about constructing number patterns generated by a race between a tortoise and a hare and using these patterns to graph the situation.

Guide to Teaching a Problem-Based Science Curriculum (ENC-014782)

Grades 6-8
Kendall/Hunt Publishing Company, toll-free: (800) 770-3544, **$32.95**

This book, developed as part of the Problem Based Science Units series, provides guidelines for the implementation of seven problem-based learning (PBL) units. The text provides background information about the PBL: approach and specific guidelines for implementing it in the classroom.

Through Mathematical Eyes: Exploring Relationships in Math and Science (ENC-011369)

Grades 6-8
Greenwood Publishing/Heinemann Educational Books Inc., toll-free: (800) 793-2154 **$19.50**

This book, from the Moving Middle Schools series, presents vivid, revealing stories of how the teaching of the concept of functions can play out in diverse middle school classrooms ranging from rural Maine to urban San Francisco.

Tools for Understanding: A Resource Guide for Extending Mathematical Understanding in Secondary Schools (ENC-016331)

www.ups.edu/community/tofu

Grades 7-12

This World Wide Web site is intended to help intermediate and middle grade mathematics teachers, including those who teach remedial math classes and secondary special educators, show students the connection between mathematics and its application in everyday contexts. Winner, Digital Dozen 1/2000.

Dennis Kunkel's Microscopy: Science and Photography Through a Microscope (ENC-016731)

www.pbrc.hawaii.edu/kunkel

Grade 7 and up

This web site is the home page for renowned microscopist Dennis Kunkel. It showcases his commercial work, provides information about his publications, and features resources for colleges, schools, or individuals who want to learn more about microscopy.

High School Mathematics at Work: Essays and Examples for the Education of All Students (ENC-012661)

Grades 9-12
National Academy Press (NAP), toll-free: (800) 624-6242 **$27.95**

This book of essays examines how high school mathematics can and should help students deal with situations they encounter in their everyday lives. This book is organized into four themes. Connecting Mathematics with Work and Life, The Roles of Standards and Assessments, Curricular Considerations, and Implications for Teaching and Teacher Education.

Sources of Real Data

National Oceanic and Atmospheric Administration (NOAA) Home Page (ENC-009874)

www.noaa.gov

Grades K-12
National Oceanic and Atmospheric Administration (NOAA)

Maintained by the U.S. Department of Commerce, this web site provides information about the National Oceanic and Atmospheric Administration, whose mission is to describe and predict changes in Earth's environment and to conserve and manage the nation's coastal and marine resources to ensure sustainable economic opportunities.

WhaleNet (ENC-004126)

whale.wheelock.edu

Grades K-12
Collaboration of the Biology Departments at Wheelock College and Simmons College

This web site, funded by the National Science Foundation, enables students to collect and analyze data on many whale species right from their classrooms. WhaleNet offers curriculum resources and support, a source of data for interdisciplinary classroom activities, and interactive informational support through WhaleNet/EnviroNet. Winner, Digital Dozen 4/1996.

Government Information Sharing Project USA Counties 1996 (ENC-002257)

govinfo.kerr.orst.edu/index.html

Grades K-12
Oregon State University

Part of the Government Information Demonstration Project web site, this site provides access to information from the United States Census Bureau database on USA Counties. The database compiles demographic, economic, and governmental information spanning several years and Sources. Winner, Digital Dozen 10/1996.

Explore the GLOBE Program (ENC-009304)
globe.fsi.noaa.gov

Grades K-12
Global Learning and Observations to Benefit the Environment (GLOBE) Program
Publisher: National Oceanic and Atmospheric Administration (NOAA)

Global Learning and Observations to Benefit the Environment (GLOBE) is a worldwide network of K-12 students, teachers, and scientists working together to study and understand the global environment. GLOBE students make a core set of environmental observations at or near their schools and report their data via the Internet. Winner, Digital Dozen 9/1995, 11/1996, 5/1998.

National Weather Service (NWS) (ENC-014698)
www.nws.noaa.gov

Grades K-12
National Weather Service (NWS)

This site, maintained by the National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS), provides direct access to U.S. official weather forecast information. Users have access to national weather data including radar summary charts, weather conditions for the past 24 hours, weather maps, and international weather conditions.

Online with Accu-Weather: Instructional Modules in Meteorology (ENC-014419)
http://www.accuweather.com/weatherf/index_corp

Grades 7-12
1991
Elliot Abrams, James Levin, Barry Lee Myers, Alfred Palmer, Fred Withum III, Wade Shumaker
Ordering Information
Kendall/Hunt Publishing Company, (800) 770-3544, www.kendallhunt.com/
$9.75 per student edition; **$25.00** per teacher's manual

This book contains 10 instructional modules in which students access real-time weather data and information from Accu-Weather's online database of radar and satellite information, computer forecasts, and guidance prepared by many of the federal government emergency-preparedness information agencies such as the National Hurricane Center and the National Severe Storm Center.

Boil, Boil, Toil and Trouble: The International Boiling Point Project (ENC-015776)
k12science.stevens-tech.edu/curriculum/boilproj

Grades 6-8
developed and managed by the Center for Improved Engineering and Science Education (CIESE)
Standards: National Science Education Standards (December 1995), NCTM Curriculum and Evaluation Standards (1989)

This web site is designed to allow students to participate in an international inquiry to discover which factor (room temperature, elevation, volume of water, or heating device) has the greatest influence on boiling point of water. In order to participate, students boil water, record their information, and send it via email to be included in the database of results. Winner, Digital Dozen 10/1999.

Six Billion and Beyond: Population in the New Millennium (ENC-016490)
www.pbs.org/sixbillion

Grade 6 and up
creative direction/design, Amy Walsh; content development, Megan Gelstein; PBS Online
Publisher: PBS Online

This site explores population issues as they affect peoples' lives and countries. A clickable world map serves as the entry to population information about China, India, Italy, Kenya, Mexico, and the United States. A counter keeps track of world population and notes how many babies are born during a visitor's tour of the site. Winner, Digital Dozen 1/2000.

WWW Resources for Teaching Statistics (ENC-012446)
it.stlawu.edu/~rlock/tise98

Grade 6 and up
Robin H. Lock

This site is designed to direct browsers to web sites that typify the various online resources available to support statistics instruction. Sections include the following: online course materials for introductory statistics, Advanced Placement preparation, and multivariate statistics courses. Winner, Digital Dozen 7/1998.

The Global Water Sampling Project (ENC-016655)
k12science.stevens-tech.edu/curriculum/waterproj/index.html

Grades 6-12
Connie Rogers, in conjunction with the Stevens Institute of Technology, Center for Improved Engineering and Science Education (CIESE)
Standards: National Science Education Standards (December 1995)

This online project provides a format for students around the globe to collaborate in fresh water testing. This project has three primary purposes: to identify organisms in the water and see if they are present in other, more distant, water sources; to assess the quality of water based on physical characteristics, chemical substances, and biological indicators; and to look for relationships and trends among the data collected by all project participants.

The Data and Story Library (DASL) (ENC-012429)
lib.stat.cmu.edu/DASL

Grades 7-12
Matthew Hutcheson, Mika Meyer

This web site is an online library of data files and stories that illustrate the use of basic statistics methods. It is designed to provide data from a wide variety of topics so that statistics teachers can find real-world examples that will be interesting to their students.

DNA for Dinner? (ENC-016070)
www.gis.net/~peacewp/webquest.htm#Introduction

Grades 9-12
William E. Peace

This web site is intended as a structured activity or lesson plan that introduces students to the practical mechanics and societal implications of the genetic engineering of plants grown for human consumption. The site also encourages students to learn about public policy and shows how ordinary citizens can become part of the decision making process for issues that are important to them. Winner, Digital Dozen 10/1999.

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○ mathematics education
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